

Regional Competitive Advantage and Transportation Planning: An Extended ReS/SITE Framework

by

James W. Grube

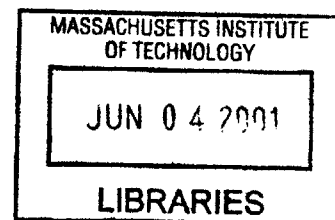
B.S., Industrial Engineering
Purdue University, 1994

Submitted to the Department of Civil and Environmental Engineering
in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE IN TRANSPORTATION

at the
Massachusetts Institute of Technology
June 2001

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Submitted to the Department of Civil and Environmental Engineering
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ABSTRACT

Considerations for economic development within transportation planning often focus on narrow measures of economic benefits such as job and wage growth, or the value of travel time savings. Regional economic development depends more strongly on sources of competitive advantage, often associated with industry clusters and their sustained productivity growth. To better address regional economic development needs, a strategic planning process should consider transportation investments which more effectively support regional industry clusters. An extension of the ReS/SITE (Regional Strategies for Sustainable Intermodal Transportation Enterprise) framework was seen as providing a logical interconnection between competitive advantage theory, as advanced by Professor Michael Porter of the Harvard Business School, and strategic transportation planning through its use of regional architectures.

There are four major components to this thesis. First, this thesis provides background on the concept of regional competitive advantage and its relationship with industry clusters and economic development. Second, it reviews the relationship between economic development and transportation planning: exploring case studies of past regional competitive advantage analyses and evaluating the degree to which the results were integrated within a region's transportation plans. Third, it extends the ReS/SITE framework by integrating the concept of regional competitive advantage within a region's on-going transportation planning process. Fourth, and finally, it evaluates the New England region's transportation needs within the context of the proposed framework.

The result of this work is to extend the ReS/SITE framework to include Regional Economic Development Architecture (REDA) to accompany the previously established Regional Planning Architecture (RPA) and Regional Service Architecture (RSA). The extended architecture reflects the need to better integrate transportation and economic development plans by identifying and improving the institutional linkages between economic development and transportation organizations. Using clusters as a frame of reference, the REDA architecture gives additional insight into economic development needs that might not typically be considered within the transportation planning process.

The analysis suggests that although it is difficult for regional transportation planning to support individual clusters' specialized needs, by considering clusters collectively for a particular region, it is possible to identify transportation needs which might not be generated by the conventional planning process with its narrow economic benefits focus.

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Acknowledgements

First, I would like to acknowledge and thank my advisor, Professor Joseph Sussman, for all his support during my time as a graduate student at MIT. He has been there from start to finish, helping to develop the direction of this research topic, providing guidance in matters above and beyond this thesis along the way, and reviewing several versions of this manuscript.

I would also like to express my gratitude to Professor Nigel Wilson and Professor Peter Belobaba who have both enriched my experience at MIT by teaching the value of critical thinking and opening my mind to new perspectives.

I am grateful for the financial support provided by the U.S. Department of Transportation through its Eisenhower Fellowship program. Dr. Ilene Payne's dedication to the recipients of this program and her persistence in finding funding for all of us is greatly admired and appreciated. On the topic of financial support, I would be remiss if I did not thank the people at Northwest Airlines for their willingness to hire me three times...and counting.

Special thanks go to Tom Kennedy and Jeff Sriver who relentlessly encouraged me to return to school, and to MIT in particular. They are both incredible role models, and I consider myself extremely fortunate to benefit from their mentoring.

The people who helped make my life fun during my time at school were invaluable. Elton Lin and Mark Schofield provided countless hours of companionship during our "rain or shine, sleet or snow" runs along the Charles River; thanks for setting the pace. Richard Hoppe and Georges Darido were frequent teammates, study partners, and dinner companions; always available to give advice or aid in procrastination. I would also like to thank Chip Bellinger for providing general amusement and a fresh source of laughter on a regular basis over the years.

Without my family, I would not have made it this far. I sincerely thank my parents and sister for their faith in me and their constant encouragement throughout my life. My brand-new mother-in-law and father-in-law also deserve thanks. They have warmly welcomed me into their family, and their visits and frequent calls to Boston were a constant source of inspiration and happiness for me.

Most importantly, I thank my wife, Diane, for always being there. Her love and support will always mean the most to me.

Finally, this thesis is dedicated to the memory of William Grube and Jack Toby – who began the graduate school journey with me, but were unable to see its completion – their counsel is missed.

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Important Acronyms

Acronym	Description
ABAG	Association of Bay Area Governments
ASEAN	Association of Southeast Asian Nations (ASEAN)
ASPED	Arizona Strategic Planning for Economic Development
BAEF	Bay Area Economic Forum
BART	Bay Area Rapid Transit
CAA	Clean Air Act
CALTRANS	California Department of Transportation
CBA	Cost-Benefit Analysis
CBD	Central Business District
CI	Cluster Initiative
CLIOS	Complex, Large-Scale, Integrated Open Systems
CMA	Congestion Management Agency
CMP	Congestion Management Plan
CRA	Comprehensive Regional Architecture
DECD	Department of Economic and Community Development (Connecticut)
DOC	Department of Commerce
DOT	Department of Transportation
EDAB	Economic Development Alliance for Business (Bay Area)
EPA	Environmental Protection Agency
EU	European Union
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GDP	Gross Domestic Product
GNP	Gross National Product
GRP	Gross Regional Product
GRTA	Georgia Regional Transportation Authority
GSP	Gross State Product
GSPED	Governor's Strategic Partnership for Economic Development (Arizona)
GTEC	Greater Tucson Economic Council
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation System
JIT	Just-in-Time
JVSV	Joint Venture Silicon Valley
LQ	Location Quotient
MAC	Metropolitan Airports Commission (Twin Cities)
Massport	Massachusetts Port Authority – Operator of Logan Airport and the Port of Boston
MIS	Major Investment Study
MIT	Massachusetts Institute of Technology
MnDOT	Minnesota Department of Transportation
MTC (1)	Massachusetts Technology Collaborative
MTC (2)	Metropolitan Transportation Commission (Bay Area)
MPO	Metropolitan Planning Organization
NAFTA	North American Free Trade Agreement
NEBHE	New England Board of Higher Education

Acronym	Description
NEEP	New England Economic Project
NEGC	New England Governor's Conference
NEPPC	New England Public Policy Collaborative
NETC	New England Transportation Consortium
NETI	New England Transportation Initiative
NHIG	New Hampshire Industries Group
PAG	Pima Association of Governments (Tucson)
RASP	Regional Aviation System Plan
REDA	Regional Economic Development Architecture
ReS/SITE	Regional Strategies for the Sustainable Intermodal Transportation Enterprise
RI	Regional Infrastructure
RIDOT	Rhode Island Department of Transportation
RIPTA	Rhode Island Public Transit Authority
RIEDC	Rhode Island Economic Development Corporation
RIEPC	Rhode Island Economic Policy Council
RPA	Regional Planning Architecture –or– Regional Planning Authority
RSA	Regional Service Architecture
RSTP	Regional Strategic Transportation Planning
RTB	Regional Transportation Blueprint
RTP	Regional Transportation Plan
SELAC	Southeast Los Angeles
SEPTA	Southeastern Pennsylvania Transportation Authority
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SRTP	Short-Range Transit Plan
STIP	State Transportation Improvement Program
STP	Statewide Transportation Plan
TAB	Transportation Advisory Board
TEA-21	Transportation Equity Act for the 21 st Century
TIP	Transportation Improvement Program
TMSP	Tucson Maquila Supplier Program
TWP	Total Weighted Performance
UTC	University Transportation Center

Chapter 1. Introduction

1.1 Thesis Background and Motivation

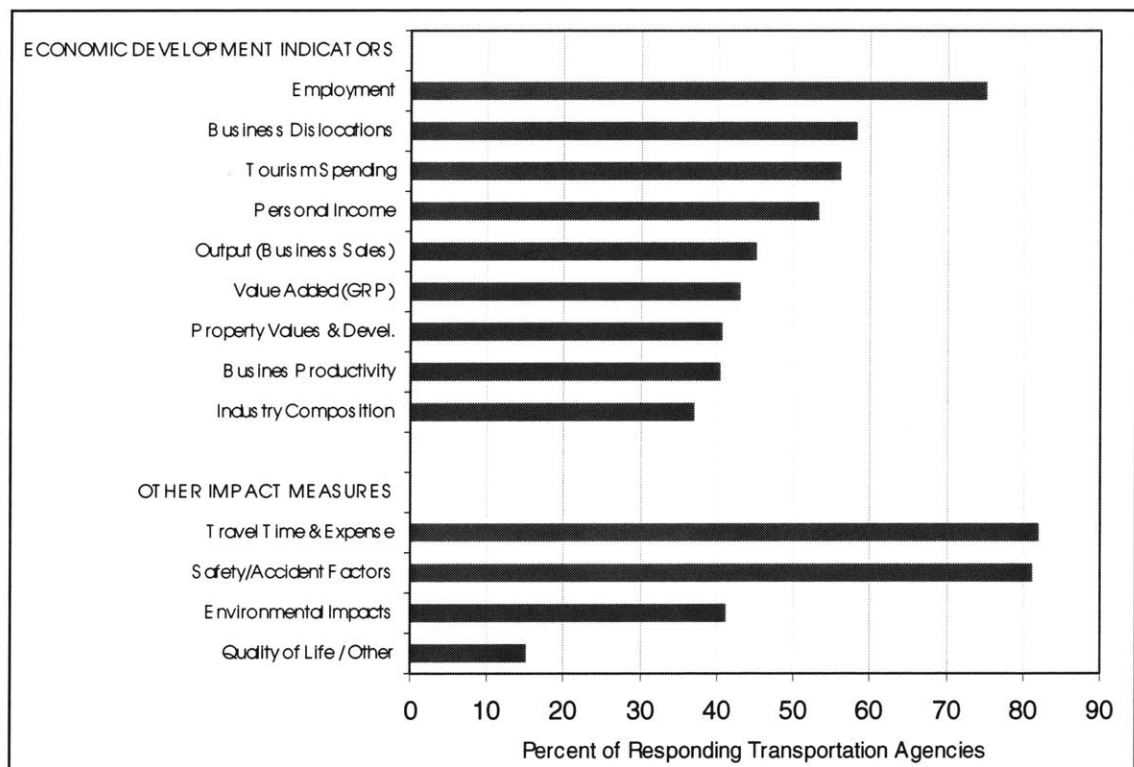
With focus on globalization in today's growing information- and knowledge-based economy, the inclination has been to see location and geography as diminishing in importance. However, as trade borders disappear, regions are emerging as the defining economic entity [1]. Because not all regions prosper economically in the same way, industry, government, and academic leaders have searched for an understanding of what dynamics create a competitive advantage for a particular region.

The competitiveness of a region is a strong function of its productivity, or the value of the region's output produced by a unit of labor or capital. Therefore, to generate and maintain a competitive advantage, a region should have sustained *productivity growth* through continuous innovation and upgrading of its economy. To understand the components of productivity growth, it is necessary to focus on (1) specific industries and industry segments, *not* the region's economy as a whole; and (2) the critical characteristics of a region that allows these specific industries to create a competitive advantage [2]. These regional-specific industry segments are often called clusters.

The productivity of a cluster is, in part, influenced by the efficiency and quality of its industries' basic inputs, one of which is the quality of the region's transportation infrastructure and its operation. This input is one of several policy levers that government entities can pull to facilitate productivity growth. Because the sources of competitive advantage are at the regional level, the most important government roles are at the state and metropolitan area level, rather than national. In practice, the government agencies and municipalities tend to plan their transportation infrastructure using a reactive approach in response to their own geographic area, with little or no coordination or integration at the regional level. For example, an economic development agency may perform cluster analyses in order to support revitalization of existing industries, while a Metropolitan Planning Organization (MPO) is independently creating a twenty-year transportation plan. Meanwhile, a state Department of Transportation may be concurrently modeling the economic development impacts of various route alignments in order to evaluate a proposed highway investment.

Most of these studies focus on overly narrow measures of economic benefits for the region as a whole, such as job or wage growth, and business output (sales). However, competitive advantage of the region is largely dependent on how effectively its industry clusters are served by the transportation infrastructure. The impact of an improvement in the region's transportation infrastructure should be measured by its capacity to induce productivity growth at a regional scale.

A recent study published by the Transportation Research Board [3], showed that two of the most important measures of competitive advantage (productivity and industry composition) are the least likely to be used in evaluating the economic impacts of a proposed transportation project as shown in Figure 1-1.



Source: Weisbrod, 2000

Figure 1-1: Economic Impact Indicators used by Transportation Planning Organizations

What is needed is a shift towards a strategic regional transportation planning approach which identifies, develops, and integrates the infrastructure factors that will (1) effectively support local industry clusters and (2) create the opportunity to develop and maintain a regional competitive advantage through productivity growth.

MIT's ReS/SITE (Regional Strategies for the Sustainable Intermodal Transportation Enterprise) framework provides a logical interconnection between regional competitive advantage theory and regional strategic transportation planning. The ReS/SITE framework (discussed in Chapter 4) was developed to assist in overcoming weaknesses of conventional transportation planning. The framework incorporates the use of (1) scenarios to identify robust planning strategies rather than a static or fixed "single" future condition; and (2) regional architecture as a tool to integrate agency organizational interactions within strategic planning.

1.2 Thesis Objectives

The purpose of this thesis is to expand an established theoretical framework (ReS/SITE) to address the notion of regions as competitive with each other in the regional transportation planning process. The resulting product will be evaluated within the New England context where the future competitive ability of the region is uncertain. The objectives of the thesis will be to:

1. Define the concept of regional competitive advantage and its relationship with industry clusters and economic development. Discuss the role transportation infrastructure plays in enabling and sustaining a region's competitive advantage.
2. Provide background on the current theoretical assessment of the impact of transportation infrastructure on economic development, illustrate the methods employed in practice to measure this impact, and review a recent framework for linking transportation investment to economic development.
3. Explore past competitive advantage analyses and the corresponding regional transportation plans to assess if there is a mismatch between infrastructure needs for a region's clusters and the objectives or goals driving the transportation planning process.
4. Provide a framework for integrating the notion of regional competitive advantage within a region's ongoing transportation and economic development planning process.

1.3 Thesis Methodology and Structure

Based on the motivation and objectives for this work, the following methodology and structure will be used for this thesis:

Chapter 2: Relate economic development to regional competitive advantage, describing the methodology that economic development organizations utilize to evaluate their region's competitive advantage and cluster composition

Chapter 3: Review the literature regarding the current theory linking transportation infrastructure and economic development. Survey the analysis methods and tools used to measure the impacts, and critically assess the state of the practice

Chapter 4: Explore the typical regional transportation planning process, the development of the transportation plans, and introduce the ReS/SITE framework

Chapter 5: Conduct a review of four case studies: (1) the San Francisco Bay Area in California, (2) Tucson, Arizona, (3) the Twin Cities in Minnesota, (4) and the Transportation Cornerstone Project in Florida. For each case, examine:

- The regional economic development organizations and the institutional relationships between them
- The industry clusters contained within the region, the manner in which they were identified, and the transportation infrastructure needs, if any, which were identified by the cluster analyses
- The region-specific transportation planning process and responsible organizations
- The institutional links between the transportation planning and economic development organizations and the degree to which the industry cluster needs are reflected in the regional transportation plans

Chapter 6: Based on the findings in Chapters 2 through 5, develop a framework for integrating the notion of regional competitive advantage within a region's ongoing regional transportation and economic development planning process, using the ReS/SITE framework as a foundation

Chapter 7: Apply the proposed framework to New England:

The New England region is chosen because although the region has experienced economic growth over the past decade, growing congestion has the potential for constraining future growth and limiting the quality of life. New England economic development has relied heavily on industries that are relatively travel-intensive: financial services, communication services, high-tech hardware and software, post-secondary education, and biotechnology. While the U.S. service industry grew 25% from 1992 to 1997, Massachusetts experienced an 86% growth in the same sector [4]. For the region to grow in these markets, it must have well developed intra-regional as well as inter-regional connections. New England's primary transportation infrastructure, such as I-95 and Boston's Logan Airport, are experiencing capacity constraints that threaten the future ability of the region to sustain its current growth and competitive ability. The New England region also experiences economic disadvantages associated with its location in the northeast corner of the nation, the associated higher costs of doing business, and a chronic shortage of a skilled labor pool. These disadvantages cannot be eliminated entirely, but a forward-looking planning framework might assist in minimizing costs by efficiently investing in the appropriate transportation infrastructure needed to support regional productivity growth.

The use of the framework within the New England context will first require the establishment of the fact that New England is composed of more than simply six state political jurisdictions, but in fact represents an economic region. Next, transportation issues which impact the entire region will be explored and potential infrastructure investments to address these pressing issues will be cataloged. A state-by-state look at industry cluster studies will examine the degree to which specialized transportation infrastructure needs are reflected in the state transportation plans. Finally, an evaluation will be made regarding the degree to which regional transportation needs are addressed individually by each New England state, and the implications for the competitive advantage of the region.

Chapter 8: Summarize the thesis, identify the key contributions of the thesis, and suggest several areas for future research.

Ultimately, the goal of this thesis is to provide insight as to how the notion of regional competitive advantage fits within the regional transportation planning process. The chapters that follow are devoted to this effort.

Chapter 2. Regional Competitive Advantage and Clusters

The purpose of this chapter is to introduce and define the concept of regional competitive advantage as well as one of its theoretical outcomes: industry clusters. The first step involves developing an understanding of the growing importance of regions, and why location still matters in a time of widespread globalization and low-cost telecommunications. Next, the theory of regional competitive advantage and industry clusters is presented, along with a critical analysis of whether or not the theory is simply the latest in a long line of economic development “fads” or truly a lasting theoretical foundation. The main emphasis of this chapter will be the introduction of a common framework for implementation of a cluster-based economic development strategy within a region. Finally, the chapter concludes with the identification of several roles transportation infrastructure investment and services may play within a cluster-based strategy.

2.1 Regions

During the last few decades, regions have assumed greater importance as a focus of economic development policy and practice. The influence of regions in American government and society is not new, having been recognized for over a century since the union of the five boroughs of New York City created a regional metropolis [5]. However, as recent as twenty years ago, regionalism was narrowly conceived, usually not discussed, and minimally influential. More recently, the common geopolitical models of hierarchical, governmental, industrial, or military nation-states were challenged. Economists, policy-makers, and politicians have begun to break away from the nationalistic paradigm and are increasingly viewing regions in terms of their economic, social, and strategic importance. Europeans understand this, and often describe their continent as a collection of increasingly powerful city-states [6].

2.1.1 Defining the Region

There is no agreed-upon definition of the term “region.” Traditional views of regions tended to classify them into three types: (1) Policy-oriented regions defined by political alliances or regional trading blocs such as the European Union (EU) or Association of Southeast Asian Nations (ASEAN); (2) Homogenous-oriented regions with respect to some physical, social, or economic characteristic; or (3) Nodal-oriented regions focused around a central urban place. None of these definitions captures the internal economic and cultural dynamics of a region [7]. For example, people travel across city, county, state, and country boundaries to work. Networked industries provide an economic base across geographic borders. The media relies heavily on a

regional marketplace. Economic infrastructure connects systems between nations and geopolitical regions. Air, water, and noise pollution cross municipal boundaries. Parks and stadiums provide identity to an area much larger than a single city [8].

In functional terms for this paper, a region is seen not as a statistical or geographic unit, but as an arena of economic, social, and political activity. This arena lies above the local and below the national levels of government. These regions vary in spatial size, form, and administrative function, involving different levels of activities by the public, private and non-profit sectors.

Pendleton (1998) provides an extensive review of the concept of regions, identifying the differences between a political jurisdiction and an economic region. His framework for assessing these two entities is presented in Table 2-1:

Characteristics	Economic Regions	Political Jurisdictions
Geographic Orientation	Contiguous	Contiguous
Borders <ul style="list-style-type: none"> • <i>Definition</i> • <i>Clarity</i> • <i>Variation over time</i> • <i>Relationship with other borders</i> 	Economically based Fuzzy, inherently unclear Change as regional economic activity expands and contracts Permeable; overlap with other regions possible	Geographically based Clearly outlined Fixed Distinct; no overlap with other jurisdictions
Internal Diversity	Internally diverse, as economic activity varies in intensity within the region	No comparable internal distinction; assumption is that jurisdiction equals uniform entity
Relationship with other similar entities	Interdependent	Independent
Integration of rural areas	Unclear, because geographic extent of borders is unclear	Clear, because they cover the entire geography of the nation

Source: Pendleton, 1998

Table 2-1: Comparison of Economic Regions and Political Jurisdictions

For evaluating transportation investments within the context of regional competitive advantage, the economic region is usually identified as the appropriate unit of geographic scale.

2.1.2 The Growing Importance of Regions

Over the last several decades, industrial shifts, often characterized by the term globalization, have occurred in response to massive technological changes such as dramatically lower transportation costs, standardization of production, and rapid, low-cost telecommunications. The result is that regions have not only emerged as subsets of national space, but as units of international space. Increasingly, regions are given the opportunity to compete and cooperate with counterpart regions

across nation-state lines and continents. The local government scale is viewed as increasingly too small to be economically viable in the resulting global economy. At the other end of the spectrum, while nations are still the prominent unit for defense, the national scale of government is viewed as both too large to manage everyday life and too small to regulate international affairs. Consequently, regions may be the appropriately sized unit for competing effectively. McCarthy (2000) identifies four factors leading to the growing importance of regions [9]:

- (1) Certain challenges can be addressed more effectively at a regional scale because individual local governments lack the capacity or resources to address some issues without the cooperation of neighboring jurisdictions. Issues that present opportunities for regional cooperation include: strategic economic planning, education and workforce preparedness, research and development, transportation and communication infrastructure, urban growth management, as well as social service, healthcare and emergency response systems.
- (2) Managing resources at a regional scale may make more economic and environmental sense. Inefficient land use and transportation patterns can have negative effects on regional air and water quality and congestion, which can adversely impact future regional growth and economic development efforts. Certain infrastructure can be provided more cost-effectively through cooperative efforts at a regional, rather than local level because of the economies of scale afforded by the larger spatial area and population.
- (3) Declining federal funding is prompting local and state governments to look to cooperative efforts as a means of more efficiently employing their limited resources to meet increasing demands.
- (4) Social and industrial networks are evolving beyond established political boundaries. The main economic linkages of regions, such as those involving information, skill, trade, and investment, are increasingly with the global economy, rather than within their own national economy.

2.2 Regional Competitive Advantage

2.2.1 Competitive Advantage

The word “competition” conjures images of a contest or rivalry with opponents locked in a struggle against one another attempting to gain an advantage as measured by some benchmark. While competitiveness has drawn the attention of governments and industry alike, an accepted definition of the term as applied to a region is difficult to find. Rodriguez (1997) defines the competitive success of a region as “measured by its ability to offer its members access to low-cost, quality goods; to provide low-cost resources; and to foster development and regional prosperity [10].” Traditionally, prosperity was seen as a natural outcome of a region’s natural resources. Today, the consensus is that prosperity is created, not inherited [11]. To understand the creation of prosperity through regional competition, Michael Porter’s framework of competitive strategy is commonly used. In his framework, Porter claims the only meaningful measure of a region’s competitiveness is productivity – the value of the output produced by a unit of labor or capital. Productivity depends on both the quality and features of the output, and the efficiency at which it is produced. Porter argues that a region is said to gain a competitive advantage if it is able to sustain growth in productivity[12].

Sources of Competitive Advantage

Porter’s competitive framework challenges the traditional determinants of competition. The five most commonly cited sources of competitive advantage have typically been: (1) macroeconomic phenomenon such as interest rates and exchange rates; (2) availability of low-cost labor; (3) government policy such as subsidies and tariffs; (4) availability of natural resources; and (5) differences in management practices. Though each source affects the competitive position of a region’s economy, Porter argues that none are sufficient alone, and a more complex system must exist [13].

Sustaining Competitive Advantage

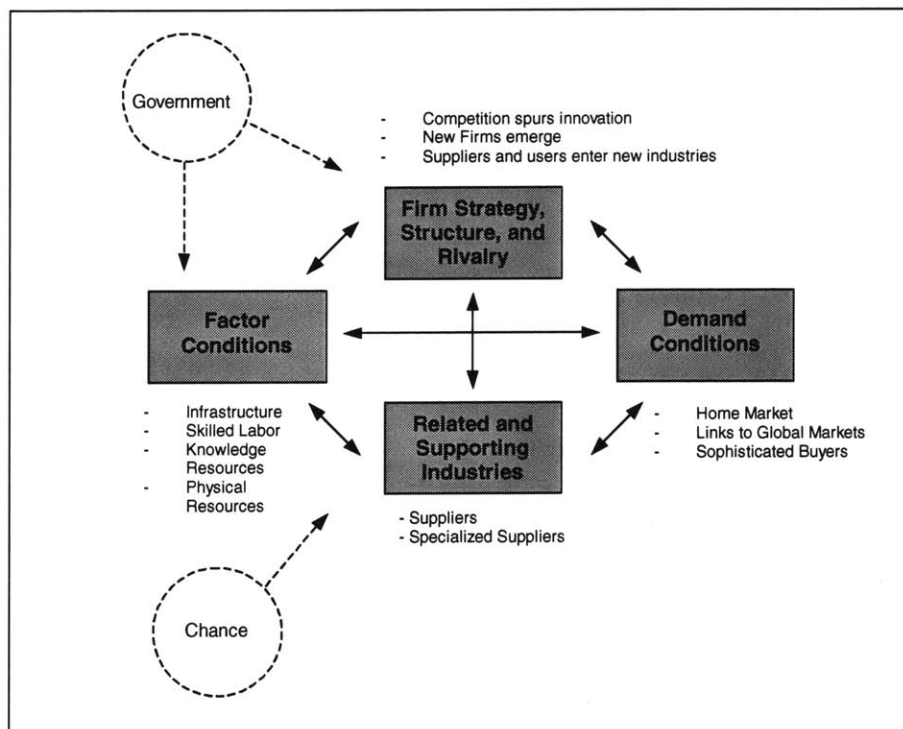
Once competitive advantage is achieved, sustaining it requires that an economy continually upgrade itself. By upgrade, Porter is referring to improving productivity by increasing production quality, capabilities, technology, or efficiency. Upgrading also entails developing the ability to compete in new segments where a competitor’s productivity may already be high, and the capability to compete in entirely new industries. Industries achieve these upgrades through acts of innovation. Innovation and change are closely tied together. Productivity growth requires

change, but change is an unnatural act [14]. Past strategies become institutionalized, while dedicated facilities and infrastructure solidify past practice. To experience change, innovation is essential.

Concepts such as productivity growth, upgrading, and innovation are appealing conceptually, but are too general and static to sufficiently describe a system. The next section describes how Porter tied these concepts together into a dynamic model of competitive advantage.

2.2.2 The Diamond Framework and its Outcome

In The Competitive Advantage of Nations, Porter (1991) developed his well-known diamond framework, shown in Figure 2-1, to explain systematically why industries found in certain regions were able to establish and maintain a competitive advantage.



Adapted from: Porter, 1998

Figure 2-1: Diamond Model of Competitiveness

The points on the diamond reflects the essential determinants for achieving competitive success and are described in more detail as follows:

Factor Conditions

The first determinant of the diamond characterizes the position of a region's factors of production. Possession of the basic factors of production¹ alone is not enough to create a competitive advantage. More important is the rate and efficiency at which a region creates, upgrades, and deploys them in particular industries. To support competitive advantage, a factor must be highly specialized to an industry's needs. Specialized factors are scarcer and thus more difficult for competitors to imitate.

Demand Conditions

The second determinant refers to the regional market for an industry's product. A region with demanding and knowledgeable buyers will pressure local industries to innovate in order to meet high standards of product features, quality, and service [15]. The size of the home market is less important than its social character.

Related and Supported Industries

The third set of determinants recognize that end-users and suppliers that are located in close proximity can take advantage of rapid communication, constant flows of information, and on-going exchanges of ideas, all of which facilitate innovation.

Firm Strategy, Structure, and Rivalry

The final determinant describes the pressure for innovation and improvement that is created from rivalries between firms. Geographic proximity of competitors magnifies rivalry. The presence of a competitor tends to eliminate competitive advantages gained by a firm simply being in a certain region. Instead, geographic concentration of firms leads to an industry, rather than a single firm, seeking out and ultimately benefiting from investments in specialized factors such as infrastructure and educational institutions.

Government and chance are two variables that Porter adds to complete the diamond framework. Chance events include major shifts in foreign demand, inventions, and war. Government policies cannot alone create competitive advantages for regional industries, but they can direct and amplify the forces within the competitive diamond, acting as a catalyst.

¹ Porter's model captures the classical economic factors of production – capital, physical, and labor resources, but expands it by explicitly including the advanced factors of infrastructure and knowledge resources.

The diamond framework has powerful implications for regional economic development strategy. A natural outcome of the framework is the phenomenon of industry clustering, a concept that has become one of the leading drivers behind current economic development policy. The next section further explores this notion by constructing a working definition and examining methodologies for identifying and classifying clusters.

2.3 Industry Clusters

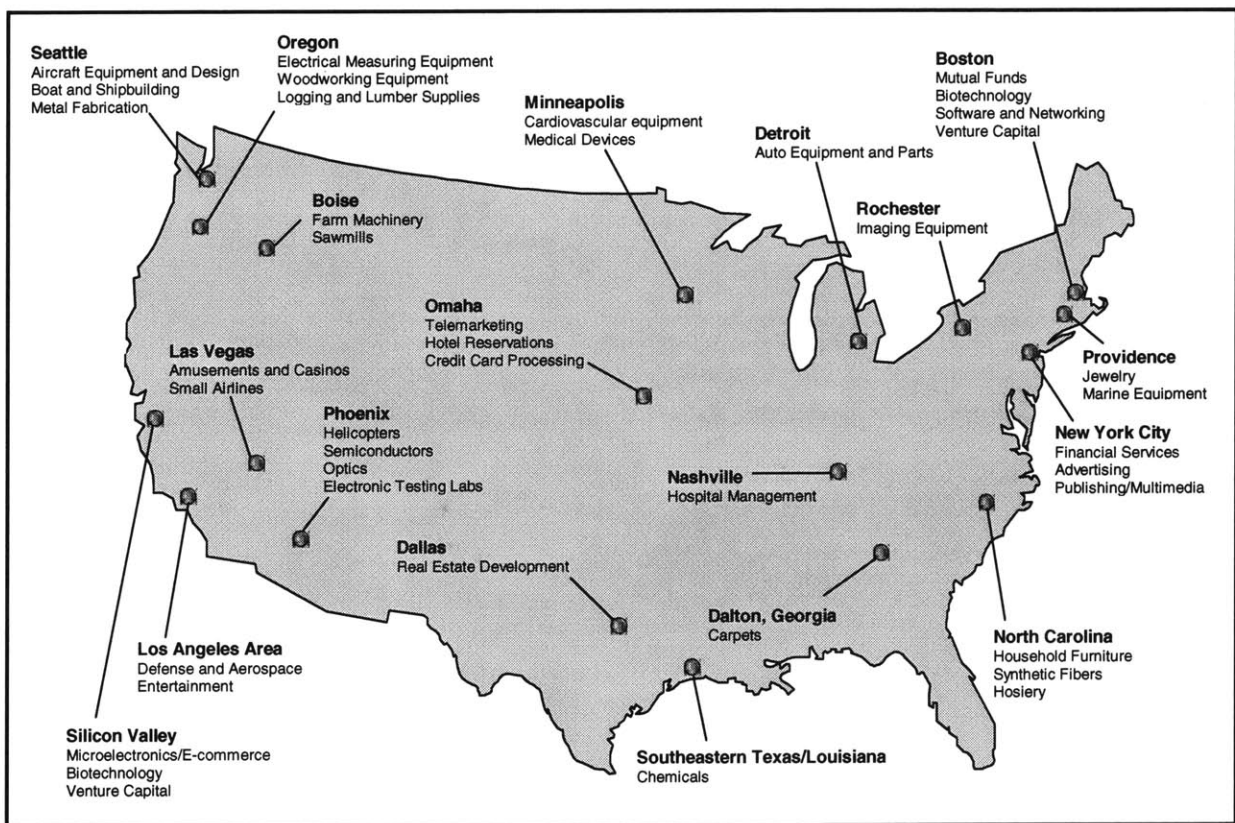
2.3.1 Role of Location and Competition

Porter identifies innovation as a critical component of competitive advantage. Historically, innovation has usually occurred in major metropolitan areas. For centuries, metropolitan cities have stimulated new forms of communication, information management, and transportation systems. In the history of innovation, place mattered greatly. Pascal Zachary, a leading urbanist, has found that certain places become highly creative and innovative for a relatively short period times of approximately 10 to 50 years [16]. As examples, he cites Manchester, England in the Industrial Revolution and Silicon Valley. These places were highly networked, with people and industries in competition, but learning from each other at the same time. Zachary defines three broad categories of historically innovative regions [17]:

- 1) Artistic Innovators: Capital cities or city-states such as ancient Athens or 19th Century Vienna. The accumulation of wealth by city-states' citizens, or periods of concentrated political power and stability, afforded the ability to invest in and pursue scientific and cultural innovation.
- 2) Industrial Innovators: Regions sufficiently near large cities, able to share in the knowledge and education base, but with an artisan-craft tradition. Examples of industrial innovators include Manchester in the 1780's, Detroit in the early 20th century, and Silicon Valley in the late 20th Century.
- 3) Urban Innovators: Large metropolitan cities faced with the logistic realities of creating new types of services for its population. Rome developed aqueducts to transport water over vast distances, and pioneered a road and bridge infrastructure system to link its far-flung empire to its centralized government authority. London faced with widespread and repeated outbreak of disease, pioneered large-scale water purification. In these examples, metropolitan cities were suddenly dealing with problems requiring either a fast learning

track or a breakdown in its social fabric. The same sense of urgency may still be found in today's cities of the developing world. Cities in developed countries faced with questions of sustainable growth and increasing congestion also have this same sense of urgency.

Although today's regional economies have access to rapid transportation and communication, and access to global markets, one finds with almost paradoxical consistency that a relatively small numbers of industries within a geographic area account for a major share of its economy. These clusters of industry suggest that location and proximity are still important determinants of competitive advantage. Porter (1998) has mapped just a few of the clusters of industry that are in located throughout the United States' economic landscape [18]. As Figure 2-2 suggests, the widespread evidence of industry clusters is compelling.



Adapted from: Porter, 1998

Figure 2-2: Select U.S. Clusters

2.3.2 Clusters and Competitive Advantage

Porter's diamond framework implies an environment that promotes clusters of competitive industries. Geographically concentrated industries become self-reinforcing, with benefits flowing backward and forward between points on the diamond (See Figure 2-1). Clusters affect competitive dynamics within the diamond framework in three broad ways: (1) increasing productivity of geographically proximate firms, (2) increasing clustered firms' capacity for innovation and productivity growth, and (3) stimulating new business formations that expands the cluster [19].

2.3.3 Clusters: A Working Definition

Porter (1998) defines a cluster as "a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities [20]. Table 2-2 lists some of the components that may be found within an industry cluster:

<u>Cluster Components</u>	
- End product or service companies	- Producers of complementary products
- Machine tool and fabrication services	- Specialized infrastructure providers
- Suppliers of specialized inputs	- Government agencies
- Financial Institutions	- Specialized educational institutions
- Firms in related industries	- Trade associations
- Firms in downstream industries	- Standard-setting agencies

Adapted from: Porter, 1998

Table 2-2: Common Components of an Industry Cluster

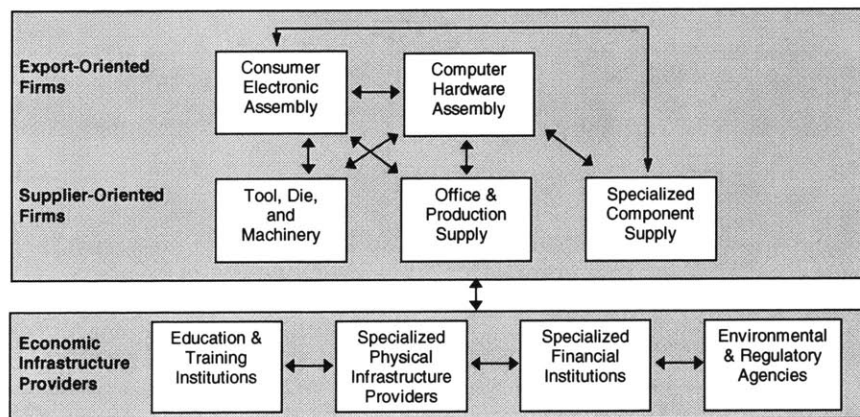
Numerous other cluster definitions exist in the literature. Examples include:

A geographically bounded concentration of interdependent businesses with active channels for business transactions, dialogue, and communications, that collectively shares common opportunities and threats [21]

An agglomeration of competing and collaborating industries in a region networked into horizontal and vertical relationships, involving strong common buyer-supplier linkages, and relying on a shared foundation of specialized economic institutions [22]

In application, the definition of a cluster is exceedingly difficult. Data and methodological constraints may partially dictate the definition of a cluster. Few definitions adequately capture and describe the underlying dynamics of a cluster, explain how they actually function, or answer questions on how firms interact and produce synergy.

For clusters to become a useful subject of analysis and policy, the concept needs to be clearly defined, but the exact criteria for clusters has depended on the institution employing the definition: (1) Government agencies, needing to avoid appearances of favoritism and needing to enlarge political support, tend to be as inclusive as possible and define cluster peripheries that match political boundaries. The result is that broad categories of businesses such as tourism, heavy manufacturing, and professional services are classified as clusters, although they appear to have little binding the firms into a production system. (2) Academia and researchers tend to focus on finding numeric parameters in order to conduct statistical or econometric analysis, resulting in traditional economic development and regional science techniques and classifications; and (3) Business schools tend to favor classification based on comparative advantage in global markets [23]. Often, a particular cluster is “mapped,” showing the important linkages between geographically concentrated industries along with their key suppliers and economic institution. Figure 2-3 displays the typical high-level structure of a “mapped” cluster, in this case, a computer manufacturing cluster:



Adapted from: Gollub, 1997, p. 2.

Figure 2-3: Sample High Level Cluster Map

Clusters are often confused with business networks,² although important differences exist between them. Networks are collaborative business activities, carried out by a discrete and small group of firms in order to generate an increase in sales or profits. In contrast, clusters are systems in which participation relies more simply on interdependence. Rosenfeld (1997) highlights the key differences between business networks and industry clusters:

<u>Business Networks</u>	<u>Industry Clusters</u>
<ul style="list-style-type: none"> • Restricted 'membership' • Based on contractual agreements • Simplify the engagement of complex business transactions between firms • Allow firms access to specialized services at lower cost • Based on cooperation • Common business goals 	<ul style="list-style-type: none"> • Open 'membership' • Based on social values that foster trust and encourage reciprocity • Generate demand for firms with similar and related capabilities • Attract needed specialized services to a region • Based on both cooperation and competition • Collective system dynamics

Adapted from: Rosenfeld, 1997

Table 2-3: Business Networks versus Industry Clusters

2.3.4 Classification and Dimension of Clusters

The strength of a cluster is derived from the inherent dynamics of the system; active linkages between cluster components are as important as concentration and proximity. Without these dynamic linkages, even a critical mass of related firms will not operate as a production or social system. Rosenfeld (1997) identifies a progressive classification of cluster types [24]:

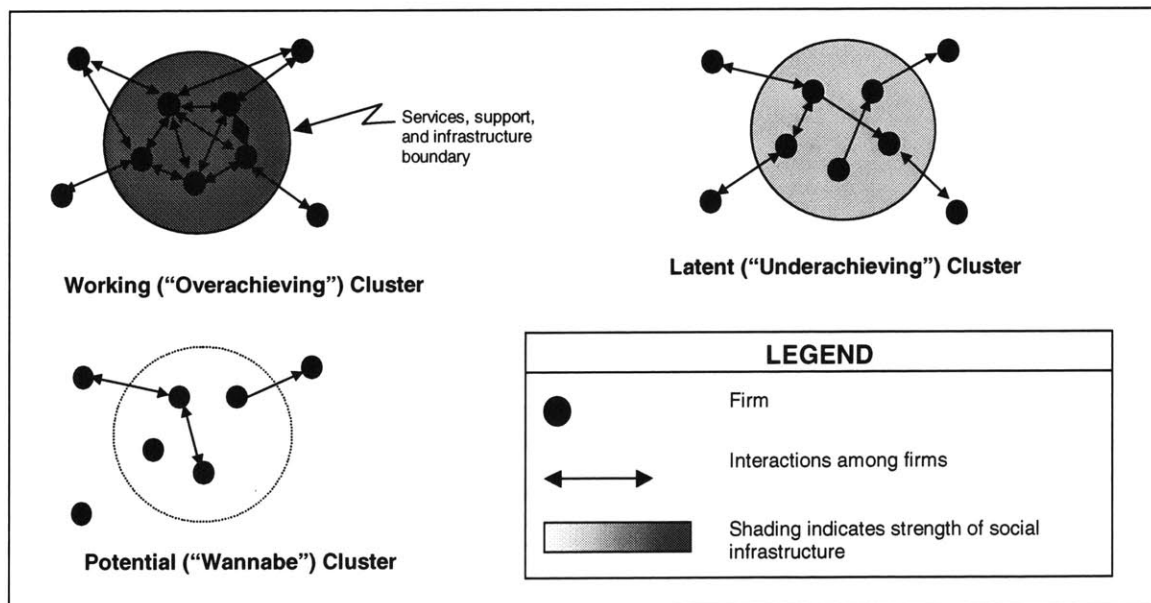
- 1) Potential ("Wannabe") Clusters: Some requirements are in place, but critical mass and key conditions are missing. There are often important gaps in inputs, services, or information flow that would typically support cluster development.
- 2) Latent ("Underachieving") Clusters: Opportunities for working clusters exist, but interactions and information exchange between firms are not exploited, nor are synergies realized. Firms within a latent cluster tend not to think of themselves as clusters and

² Also known as inter-firm cooperation or networking

often operate “without knowledge” of each other. Latent clusters often require a cluster development initiative to actively bring the firms together.

- 3) Working (“Overachieving”) Clusters: Working clusters are “self-aware,” able to realize their full potential, and produce more than the sum of their parts. Interactions among firms within working clusters tend to differ qualitatively and quantitatively from interactions with firms outside the cluster.

Silicon Valley and the Netherlands flower cluster are examples of a working cluster. Both are an agglomeration of connected companies that are aware of their interdependence, act on it, and collectively operate as a system to produce more than the sum of their parts. Firms in each cluster demonstrate the ability to learn quickly. The latent cluster is exemplified by the pharmaceutical and biotechnology companies working around Research Triangle Park in North Carolina. The industries employ over 24,000 people and have many attributes of a working cluster such as local markets and specialized support services from universities and colleges. Even so, they lack interdependence, perhaps because: (1) they are dominated by branch plants of multinational companies rather than headquarters, or (2) smaller, individual firms, and few associations or organizations exist to bring people together to interact. Figure 2-4 graphically represents the progressive classification of clusters. Notice that the boundaries of the clusters are defined not by geographic boundaries, but by economic infrastructure boundaries.



Adapted from: Rosenfeld, 1997

Figure 2-4: Progressive Classification of Clusters

Transportation infrastructure is an important component of economic infrastructure supporting the establishment, development, and growth of an industry cluster. One inference that can be drawn from economic infrastructure boundaries of clusters is that both economic activities and transportation should be planned and managed on approximately the same geographic scale. If one can accurately define the geographic scale at which cluster economic activity occurs, one can simultaneously define the appropriate scale at which transportation planning should occur [25].

Augmenting Rosenfeld's description of a progressive classification of clusters, Peters and Hood identify five dimensions of clusters, summarized in Table 2-4, which help in assessing the relative strengths and weaknesses of localized business activity [26].

Dimensions	Types	Examples
Geographic Scope	Localized Dispersed	Japan Synthetic Fabrics
Density	Dense Sparse	New York Financial Services New Hampshire Instrumentation
Activity Base	Activity-rich Activity-poor	Silicon Valley Chihuahua Maquilas
Industrial Organization	Core-ring All ring All core	Toulouse, France Aircraft Mfg.
Coordinating Mechanisms	Spot Markets Short-term Coalitions Long-term Relationships Hierarchies	Prato, Italy Textiles Hollywood Motion Picture Industry Detroit Auto Industry

Source: Peters and Hood, 2000

Table 2-4: Cluster Dimensions

Each dimension provides a different facet of cluster classification. Geographic scope refers to the spatial extent to which the cluster firms, suppliers, supporting services, institutions are found. The density of the cluster refers both to the absolute number of firms within a cluster and the economic weight of the cluster in terms of concentration of the regional industries compared to the overall national market share. The activity base of a cluster describes the frequency and importance of the activities that are carried out by the cluster firms locally within the region. The industrial organization refers to the nature of the relationships between firms and the distribution of authority among firms within the cluster. Coordinating mechanisms describe the process in which inter-firm relationships develop and are maintained over time.

Using the progressive classification and dimension characterization, clusters can be segmented into two broad categories for policy analysis: (1) clusters with good long-term growth prospects, highly localized, densely populated, and embedded within the social structure; and (2) clusters with poor long-term growth prospects and limited scope for innovation because they are either too narrow, too dispersed, or too loosely linked to the economy.

2.3.5 Identifying and Analyzing Clusters

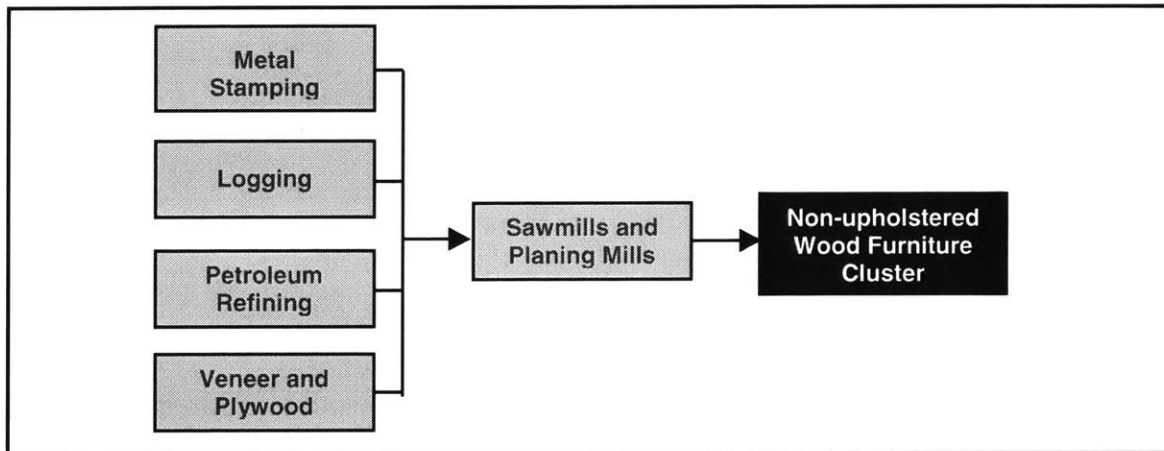
The cluster concept provides the promise of leveraging economic development while avoiding traditional zero-sum development policies [27]. However, a region interested in identifying potential clusters within its boundaries faces a difficult task. The broad definition and the regional specific context of clusters do not lend themselves well to a structured and repeatable process for identification. Most regions interested in pursuing an industry cluster analysis fall into one of three categories: (1) they have become aware of their leading industries but desire an understanding of how linkages between the industries may be strengthened to create or sustain a competitive advantage; (2) they are aware of their principal industries, but want to identify unseen linkages and perhaps underdeveloped, and unrecognized regional industries; and (3) they have little knowledge of their core regional strengths and potential, except what may be approximated from single-industry trends [28].

The state of the practice for identifying clusters relies on ad-hoc cluster definitions and tends to be narrow and neglect important linkages. The studies are often related as a narrative, similar to familiar stories relating the development of Silicon Valley and the Detroit automotive industry. The problem with these studies is that lessons and generalizations often prove difficult to apply to other regional economies. At the other end of the spectrum of the problem, when cluster identification is seen as purely a statistical exercise, significant clusters can remain obscured and unrecognized. Peters and Hood (2000) observe that linkages and complementarities across industries and economic infrastructure rarely conform to any standard industrial classification (SIC) system or to the more readily available aggregate national trade data [29]. A quantitative, statistical approach does not address whether relationships exist between firms and institutions, nor does it assess the strength and weaknesses of the linkages.

The “best practice” in regional cluster analysis is usually conceived as a two-stage process: (1) an initial scan of the regional economy using quantitative sources, and (2) a detailed, and perhaps painstaking, investigation of specific industrial features and economic infrastructure identified in

the scan, usually through more qualitative methods. The two-step approach relies on a “clean slate” with no *a priori* segmentations of the regional economic landscape. Otherwise, priorities based on a few narrowly defined industry segments may be viewed politically as too exclusive or preclude the investigation and identification of previously undiscovered clusters.

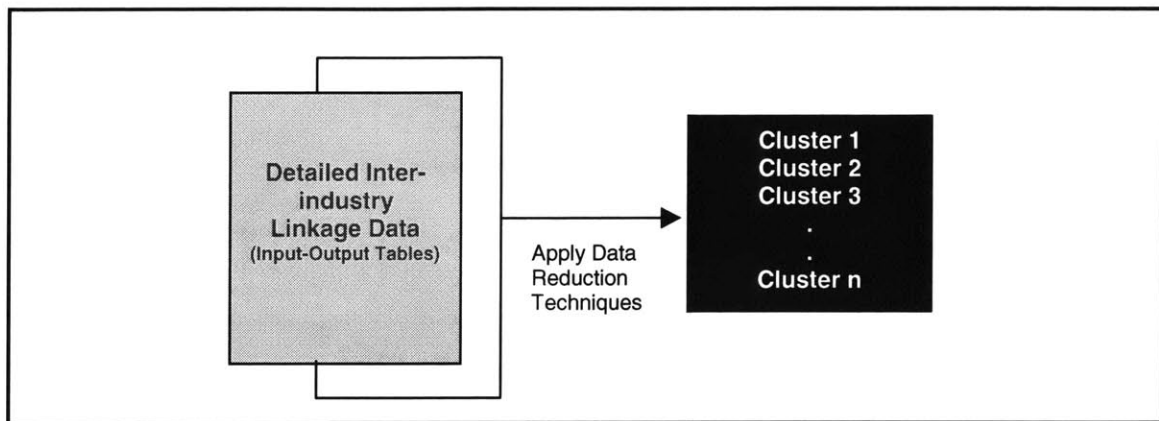
Bergman and Feser (1999) suggest that the two-step process can be applied in two different ways: a bottom-up or a top-down approach. The bottom-up approach begins with an investigation of individual sectors and discovering linkages with other industries and related non-business institutions. A picture of regional industry interdependence is built from the ground-up one sector at a time, as shown in Figure 2-5. The bottom-up approach is most appropriate for small regions with relatively few industries.



Source: Bergman and Feser, 1999

Figure 2-5: Example of Bottom-Up Cluster Approach

The top-down approach identifies clusters by a more rigorous quantitative analysis, first employing an analysis of the flows connecting regional industries, and followed by data reduction techniques (e.g. statistical cluster analysis or factor analysis). The top-down approach is shown in Figure 2-6 and is appropriate for regions where there is sufficient industry diversity to preclude a sector-by-sector piecing together.



Source: Bergman and Feser, 1999

Figure 2-6: Example of Top-Down Cluster Approach

Once an approach is determined, six analytical techniques exist in order to conduct the identification of clusters. Each technique is listed in Table 2-5, with the advantages and disadvantages highlighted. The techniques are roughly ordered in terms of how commonly they have been used.

Analytical Technique	Advantages	Disadvantages
Expert Opinion	Relatively cost and time effective. Detailed contextual information	Not generalizable. Systematic data collection very hard to do well.
Specialization Indicators (LQs)	Easy, inexpensive. Can supplement other methods	Focus is on sectors, not clusters
Input-Output: Trade Flow Data	Often only major source of data on interdependence; Comprehensive and detailed	Often dated; Industry definitions imperfect and neglects supporting institutions
Input-Output: Innovation Data	Key measure of interdependence	Data not typically available in U.S.
Graph Theory/Network Analysis	Visualization aids interpretation and analysis	Methods, software still limited
Surveys	Flexibility to collect ideal data; current	Costly and difficult to implement properly

Source: Bergmen and Feser, 1999

Table 2-5: Analytical Techniques for Cluster Identification

Expert opinion techniques are the most common approach to identify clusters and utilizes interviews, focus groups, and Delphi survey techniques. Regional experts are the key sources of

information. Though relatively cost and time effective, expert opinion is not systematic enough an approach to generalize the findings. Strongly-held opinions of experts are often overestimated. *Location Quotients* (LQs) are another common but limited means of identifying clusters. A LQ is simply a ratio of regional employment share as defined below:

$$LQ(i) = \frac{\text{Regional Industry } i \text{ Share of Total Regional Employment}}{\text{National Industry } i \text{ Share of Total National Employment}}$$

A LQ of 1.0 indicates a regional economy has the same share of employment industry i as the nation as a whole. Location quotients exceeding 1.25 are usually taken as initial evidence of regional specialization within a sector. Applied independent of other analyses, LQs offer almost no insight regarding regional clusters and their interdependencies. An *input-output analysis* framework regards each sector's output as another sector's input. Statistically analyzing production flows within a region assist in identifying interdependencies and linkages. Input-output techniques can provide useful results; given that the data is sufficiently disaggregate. *Visually mapping* clusters by graphically representing the direction and magnitude of flows between producers and suppliers is promising, but interpretation of the revealed complexities is difficult [30]. Augmenting the qualitative and quantitative approaches, clusters can be further be refined by characterizing their classification and dimension, as described in Section 2.3.4.

2.3.6 Cluster Development and Growth

No guarantee exists that a cluster will establish, develop, or grow. The process will depend heavily on the efficiency of the competitive diamond's links or feedback loops (see Figure 2-1) [31]. Similarly, relying on a concept that depends on the relative efficiency of linkages and rates of flow of somewhat nebulous concepts, such as innovation and productivity, does not lend itself well to rigorous policy intervention. Rosenfeld (1997) suggests that to facilitate cluster development, a new set of measures are needed to describe and evaluate the power of cluster dynamics and identify gaps. Though he suggests many obvious descriptors, such as number of related firms and specialized services, Rosenfeld proposes less obvious and more important benchmarks such as:

- Social Infrastructure: mechanisms by which firms associate
- Innovation: degree of regional firms' entrepreneurial energy
- Vision: level of regional firms' leadership ability
- Networking: level of collaborative business activity

These criteria, combined with the dimensions presented in Section 2.3.4, better identify the growth prospects for a region's cluster and afford policy-makers the opportunity to construct strategies that take advantage of a cluster's strengths and reduce its weaknesses.

Cluster strategies can focus on the expansion of the regional economic base, on attracting industries from outside the region, or a combination of the two. Enright (2000) describes three strategies which regions have undertaken to develop clusters within their economic infrastructure boundaries. *Organic strategies* look to broaden a region's economic base by first identifying the region's clusters and then promoting development by improving information flows and interactions among local firms, removing infrastructure constraints, and developing the appropriately skilled labor force. *Transplant strategies* attempt to develop clusters by attracting industries from outside the region that might fit particularly well within the regional economic environment and its existing base of industry, as well as developing or attracting suppliers and related support services. *Hybrid strategies* combine the previous two, usually in a sequential manner. A region may begin by actively recruiting outside investment, and after this transplant strategy has resulted in a critical mass of industries, shift focus to more organic strategies [32].

2.3.7 Role of Government in Clusters

Focus in the discussion thus far has focused on policy-makers and leadership from within the cluster. What is the proper role of government in clusters? Porter (1998) claims that clusters create new roles for government, primarily ones involving the removal of growth obstacles and the upgrade of existing and emerging regional clusters. While short on specifics, Porter argues that government agencies should reinforce and build on established or emerging clusters rather than attempting to create entirely new ones ("let the market decide"). Government reinforcement of clusters comes from removing obstacles, relaxing constraints, or eliminating inefficiencies that impede cluster productivity and innovation. As clusters mature and develop, and their sources of competitive advantage shift, the appropriate government priorities change as well. Early priorities involve improving infrastructure (such as transportation) and other factor inputs within the diamond framework (see Figure 2-1). Later roles revolve around removing constraints to innovation [33]. This approach is in contrast with many current government policies that direct resources at specific industries a region is hoping to attract, regardless of whether the existing environment is suitable for their development.

Infrastructure investment, either independently or through a private-public partnership, is often highlighted as an appropriate government role in cluster literature. Often overlooked is that cluster infrastructure needs, while obviously varying from region to region, also depend on what stage in the lifecycle a cluster is currently at. Physical infrastructure investments such as airports and highways are important early in the development of clusters, facilitating geographical concentration and linkages of regional industries. Physical infrastructure does not necessarily provide dynamic competitive advantage in later stages. As a cluster advances through its lifecycle, a region will need to focus on less tangible institutional and cultural infrastructure to create competitive advantage dynamics such as business-education partnerships, labor-management climate, and civic capacity.

2.4 Beyond Porter: Theoretical Foundations of Clusters

Clusters in practice often bear little resemblance to Porter's ideal type. Moreover, Porter's account of economic interdependence, geography, and competitive advantage is short on specifics. As a result, most of the literature on clusters takes his concepts as a point of departure [34]. In the following sections, the core theoretical foundations of why clusters exist and reasons they are important to a region are explored.

2.4.1 Are Clusters a Fad?

Economic development policy has been marked by several fads over the past fifty years. In the sixties, mature "smokestack" industries were the focus of recruitment to establish a solid job base. Focus on attracting high-tech industries such as microcomputers and telecommunications was a hallmark of development policy in the seventies and eighties. In the late eighties, policy shifted toward the recruitment of foreign firms and the establishment of a clear regional link to the global network. During the nineties, industry clusters had become the slogan of economic development [35].

The rapid succession of different policy approaches raises an important question: are industry clusters a passing fad, the latest craze in a field prone to any course of action until a more fashionable idea emerges? Some scholars have even questioned whether there is actually anything new or innovative regarding the theory industry clusters.

Fad or not, the rapid acceptance of cluster-based strategies by economic development organizations is impressive, especially in the absence of evidence that cluster-based approaches

actually work. The absence of evidence is in part because most initiatives are relatively new, and the development period is inherently long. Dissatisfaction with existing economic development strategies is perhaps a more powerful reason underlying the rapid acceptance by policy makers.

Bergman and Feser argue that the industry cluster concept has its greatest value in its capacity to help the analyst, industry leader, and policymaker see the regional economy as a whole. Industry clusters may not be as much a revolution in regional theory and models, as it is a comprehensive approach for understanding regional economic conditions and trends. In large measure, Bergman and Feser suggest that industry cluster analyses and policies may be viewed as applications of a set of well-worn but rejuvenated theories of how geography and infrastructure help drive economic growth and change [36]. Clusters are seen as permitting the possibility of linking together several strands of regional policy interests into a single framework. Therefore, even accounting for the faddish nature of economic development policy, Bergman and Feser argue that the cluster concept will likely survive in some recognizable form.

2.4.2 Five Core Theoretical Concepts for Clusters

Bergman and Feser have found that five concepts underlay the core of the existing literature on reasons for the formation of clusters and their link to competitive advantage: (1) External economies, (2) Innovation environments, (3) Cooperative competition, (4) Inter-firm rivalry, and (5) Path Dependence [37].

External Economies

Theories on why industries cluster in geographic proximity have existed for over a century. Economists have cited different types of externalities to a particular firm as reasons why firms co-locate. Agglomeration economies – defined as the cost savings firms enjoy as a result of geographic concentration – is the most frequently cited external cause of clustering. Lower transportation costs are one of most frequently cited cost savings leading to agglomeration of firms. Other advantages from proximity derive from the ability to better share infrastructure and information, and better availability of specialized facilities. These advantages, among others, relate to the well-known economies of scale concept: as industrial concentration increases, individual firms benefit from the development of institutional and physical infrastructure customized to the needs of their specific industry. A more interesting, and relatively more recent externality as compared to agglomeration, is spatial externality. These externalities are more dynamic and commonly associated with technological advances, increased specialization, and a

division of labor. From a policy perspective, this externality is sometimes considered more important than the static, agglomeration cases. For static externalities, economists argue that governments have no policy role in encouraging geographic clustering since market forces (e.g. the existence of lower input costs) will foster agglomeration. Intervention may be appropriate for dynamic external economies such as learning, innovation, and specialization. Both static and dynamic external economies have well-established and accepted roots in economics in both industrial location theory and industrial district theory.

Innovative Environments

Just as firms do not conduct business in isolation, innovation seldom occurs in isolation. Industry clusters serve as mechanisms whereby firms exchange knowledge and information that cannot otherwise be systematically exchanged. Characteristics of the regional environment may also play a role in helping firms innovate. For example, land use and design issues may help explain the unique capacity of Silicon Valley to promote innovation [38].

Cooperative Competition

The premise of cooperative competition is that competitive firms find ways to work together even as they compete head-to-head. Examples of this sort of cooperation are few, and often anecdotal in nature. Just-in-Time (JIT) inventory and delivery systems and repeated buyer-supplier interactions are cited the most commonly cited examples. The more frequent and rapid the interactions between suppliers and buyers, the more likely companies are able to identify niche markets, and quickly respond to changing market conditions. The weakness in these two examples is that they apply primarily to cooperating end-users and suppliers, rather than competing end-market producers. Bergman and Feser cite four circumstances where competing firms may see benefit from cooperation: (1) lobbying, (2) foreign market research, (3) joint export promotion, and (4) promotion and investment in specialized infrastructure.

Inter-firm Rivalry

At first glance, emphasis on inter-firm rivalry contradicts the aforementioned of cooperative competition. Rivalry is often stronger among firms that are geographically concentrated. Firms in the same region compete as rivals not just for customers, but also for labor, capital investment, publicity, and political support. This rivalry-enhanced competition is important as it creates continued pressure to upgrade technologies, improve productivity, and innovate.

Path Dependence

The idea of path dependence refers to the general notion that technological choices – even apparently inefficient or inferior ones – can assume a dominant position over other alternatives and be dynamically self-reinforcing. Leading economists, such as Paul Krugman, have recently helped legitimize this theory with support from new, more rigorous quantitative proofs [39]. In principal, an initial lead in competitive advantage may be a result as much from luck or historical accident rather than from market driven decisions. Path dependence has geographical implications because, as a general rule, businesses do indeed tend to cluster in space. Chance may establish a cluster through a “first-to-market” success, but it can be self-reinforcing and result in a cumulative advantage, or “lock-in-effect.” Because the introduction of new technology can be path dependent, regional development can also become path dependent, suggesting that being a first-mover can be critical to development success.

2.5 Developing a Cluster Strategy

2.5.1 Regional Circumstances Prompting Cluster Initiatives

The motivations for developing a cluster strategy vary substantially from one region to the next. Through a review of previously undertaken studies, Gollub (1997) has found that five scenarios emerge as typical circumstances prompting regions to initiate a cluster review and strategy process [40]:

Scenario 1 – Trade-Impacted Regions

As trade barriers fall and international competition increases, restructuring and relocation by firms have caused economic disruption in many regions. Due to new trade agreements or the arrival of more competitive products from overseas, some regions have found they can no longer compete strictly on industries based on low-cost manufacturing. In response to the passage of NAFTA, El Paso, Texas initiated a cluster analysis which identified economic linkages between the greater El Paso area, the Mexican state of Chihuahua, and eastern New Mexico. The study found substantial connections and complementarities within clusters on either side of the United States – Mexican border, but discovered significant barriers to and untapped opportunities for business growth across political boundaries. In response, the Camino Real Economic Alliance (CREA) was formed to pursue cross-border initiatives for both transportation and power infrastructure, as well as cultural expertise training for the regional firms.

Scenario 2 – Dependant and Narrow Economies

Historically, many U.S. regional economies depended heavily on federal spending in the national defense industry. With the end of the Cold War, these economies suffered greatly and looked for ways in which to redefine and diversify their economic assets. Hard hit by defense downsizing, South East Los Angeles County (SELAC) undertook a cluster-based development initiative, with the resulting plan focused on linking facility reuse of the significant defenses contractors with business recruitment. Central to SELAC's plan was the enhancement of Los Angeles' role as the premiere U.S. trade center on the Pacific Rim. The new Alameda Corridor emerged as a specialized transportation infrastructure for the region, developed expressively for the purpose of building a high-speed multimodal transportation corridor through SELAC to connect its ports to inland rail and trucking terminals.

Scenario 3 – Rural and Less Developed Economies

In regions with a limited industrial base, economic change driven by market forces or government policy is difficult and rare. Less-developed economies, often in rural areas, lack the concentration of related industries necessary to form the dynamics needed for self-sufficient clusters. However, components of cluster initiatives have been used to develop specialized competencies in industries³ to serve clusters whose principal businesses or distribution centers are located in larger, distant metropolitan areas. In effect, the rural area can become a satellite source of value to another region's clusters. With continued improvement in commercial freight services and telecommunication, more regions with specialized economic infrastructure may find themselves as linked-nodes to other regions' clusters. As the node grows, the region may attract new sources of economic growth, becoming self-reinforcing.

Scenario 4 – Disadvantaged Communities

In downtown urban areas, communities may be characterized by economic isolation, poverty, business decline, or high unemployment rates. For these communities, the cluster framework provides a means to map out key industries and economic infrastructure located throughout the region. A strategy is developed to link the disadvantaged community to economic opportunities in the larger metropolitan economy by, for example, building businesses to serve as specialized suppliers to existing clusters, or introducing specialized transportation services linking the local labor force to the regional economy.

³ Examples industries include multimedia, software, engineering, and manufacturing of specialty products

Scenario 5 – Opportunity Regions

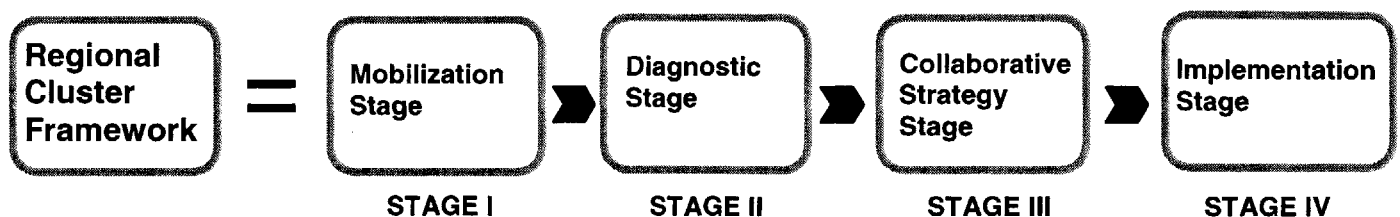
Regions whose economies are strong are also motivated to undertake cluster initiatives. In rapidly growing regions, the cluster framework helps economic development policymakers to manage growth by identifying existing and emerging clusters, determining their requirements, and recognizing the public and private investments necessary to further develop or sustain these opportunities.

2.5.2 Historical Problems Implementing Cluster Strategy

Cluster initiatives historically lack an understanding of the underlying economics of clustering and the methodology for translating cluster concepts into concrete growth policies. In practice, most cluster-based growth strategies do little to distinguish specialized needs of the clustering firms. The results are often initiatives based on broad sectors, based on wide-ranging industry predictions and forecasts, or based on the desire to compete at a national and international level without focusing on relationships at the local level [41]. Other difficulties arise in cluster strategy implementation. Effective stakeholder cooperation is difficult because of the multitude of the participants; while government agencies may take a very broad approach to avoid the perception of favoritism towards any one particular industry or firm.

2.5.3 A Cluster-Based Economic Development Framework

Because specific content and goals of cluster-based strategies vary widely from region to region reflecting unique economic circumstances, a broad framework is needed. The U.S. Department of Commerce (U.S. DOC) has developed a general framework consisting of four stages of activity as shown in Figure 2-7. The following section summarizes the framework as described in the U.S. DOC's Economic Development Administration 1997 publication: Cluster-Based Economic Development: A Key to Regional Competitiveness [42].



Source: Gollub, 1997

Figure 2-7: U.S. DOC Cluster-Based Economic Development Framework

Stage 1: Mobilization

The first stage of a cluster-based economic strategy requires widespread interest and participation. An economic window of opportunity is typically used to bring development policy stakeholders together. The window of opportunity may be an internal or external event that shakes the region's economy, or more serious external forces such as market shifts impacting an entire sector, rapidly changing technology, or tougher foreign competition for a local industry. Trigger events are often needed for mobilization as normal economic change typically happens in slow and subtle ways, making it difficult to convince stakeholders there is a need for action.

Within the economic window of opportunity, the mobilization effort is initiated by creating or identifying an organization dedicated to the initiative's goals. This organization's responsibility will be to cultivate broad private and public sector participation to achieve early buy-in. A well-structured initiative will bring together leadership from stakeholders representing the economic output side of the economy with the institutions that provide the region's economic infrastructure. Some initiatives fail early in the process because participation is limited to intermediaries such as a chamber of commerce or public planning agency. Intermediaries for the output and input sides of the economy may often sponsor or convey cluster efforts, but they cannot do the actual work of the development process alone. Typical regional stakeholders for a cluster initiative are shown below in Figure 2-8. On-going leadership for the initiative must eventually be established from these stakeholders at a regional, rather than a statewide or local level.

Economic Output Representatives	Economic Input Representatives
<u>Industry Producers</u> <ul style="list-style-type: none">• Corporate headquarters• Company regional offices• Plants and branch facilities• Suppliers• Entrepreneurs	<u>Economic Infrastructure Providers</u> <ul style="list-style-type: none">• Research institutions and laboratories• Universities and colleges• Financial institutions (banks, insurance)• Power, water, and waste utilities• Transportation providers/facilities (air, rail, road, ports)• Telecommunication systems (wire/wireless)• Health care systems and social service providers• Real estate and construction• Regulatory agencies
<u>Industry Intermediaries</u> <ul style="list-style-type: none">• Chamber of Commerce• Supplier networks• Industry associations• Employer associations	<u>Economic Infrastructure Intermediaries</u> <ul style="list-style-type: none">• Elected officials and representatives• Public agency managers• Regional planning agencies, councils of governments• Citizen non-profit groups• Development corporations• Labor and at-risk workers

Source: Gollub, 1997

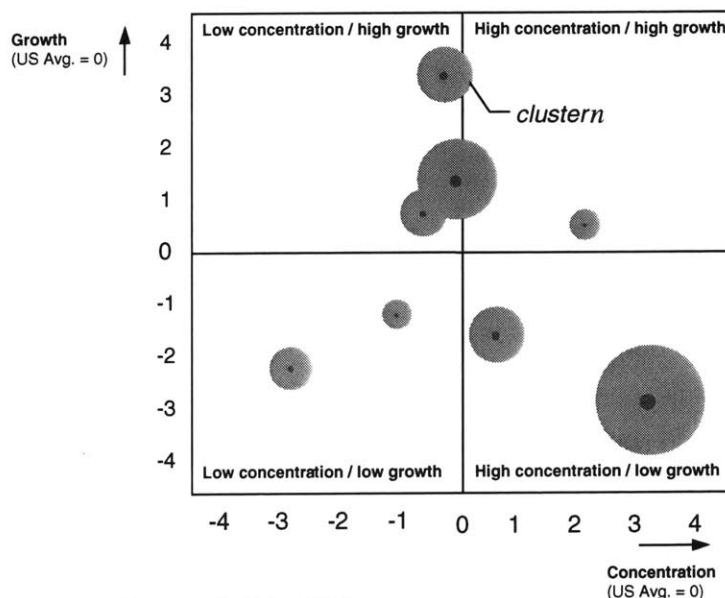
Figure 2-8: Cluster-Based Economic Development Strategy Stakeholders

Stage 2: Diagnosis

Strategies for regional economic development must be informed by a broader logic than, for example, statements such as “we need more airport capacity.” The analysis of the variety, specific structure, and relative competitiveness of the region begins with an analytically sound diagnosis of the region’s economic portfolio. Identification and classification of existing or emerging clusters proceeds in the two-step process discussed in Section 2.3.5. Cluster identification by a neutral non-stakeholder resource using sound data collection and analysis methods is necessary to dispel myths regarding the region’s economic situation and make participants more receptive to change.

Once the clusters have been identified, two benchmarks are established: (1) the clusters are assessed against similar industry clusters in key competitor regions, and (2) regional economic infrastructure is benchmarked by determining whether or not region has provided the clusters with the necessary economic inputs needed to support and create competitive advantage.

Results of the classification and benchmarking are often presented graphically to the stakeholders to simplify the complex challenges and opportunities for the regional clusters. Figure 2-9 shows an example visual representation of a hypothetical region’s clusters in a 2x2 matrix framework, with circles indicating relative size of the cluster as measured by some metric (e.g. total employment).



Source: Gollub, 1997

Figure 2-9: Cluster Growth/Concentration Matrix

High concentration and high growth clusters require good strategy and investment to maintain conditions for continued development and sustenance of competitive advantage. *High concentration and low growth clusters* typically require targeted improvements in economic infrastructure. *Low concentration and high growth clusters* need to emphasize business recruitment and a focus on the buyer-supplier chain to capture the share of growing markets. Finally, *low concentration and low growth clusters* should be a low priority for development efforts.

Stage 3: Collaborative Strategy

The stakeholders assembled for mobilization now must come together for collaborative solutions based on recognition of shared needs and negotiation of shared commitments. Working groups for priority clusters need to be brought together to define mutually beneficial actions with measurable outcomes. Each group will use the diagnostic data and individual specialized experience to define the competitive challenges facing the cluster, prioritize the challenges, and develop action items to address the shared problems. Leaders from each cluster working group are then assembled to identify common denominators in order to define cross-cutting initiatives for creating region-wide support for taking action. This becomes the basis for a regional vision and overall economic strategy.

Stage 4: Implementation

Implementation does not happen automatically once the development of cross-cluster-cutting agendas is complete. Regions may designate or create a single organization to implement the recommended agenda, while others use a mixture of public-private partnerships. New relationships and partnerships may form or be encouraged between supply and demand side economic providers. Implementation may also focus on development or improvement of the quality of regionally supplied inputs used by one or more of the clusters in the region. For example, representatives of state and local transportation agencies, airport and port authorities, and planning agencies may meet with companies in each cluster of industries to prioritize or adapt plans and programs for improving transportation infrastructure and facilities.

2.5.4 Evaluation and Critique of Cluster-based strategies

As mentioned earlier, to date, only modest research has been performed on the effectiveness of industry cluster policy in generating regional economic development. Besides the absence of

compelling evidence, several criticisms have been raised regarding the adoption of cluster initiatives.

1. Cluster policies contradict the “traditional” wisdom of regional industrial diversification. Cluster initiatives may encourage overspecialization in a regional economy leading to the danger that if a cluster fails, the regional economy fails. Critics point to examples such as the steel industry cluster in Pennsylvania. Proponents argue that successful industry concentrations can maintain their vitality by innovation-based diversification. As an example, Silicon Valley’s semiconductor industry shifted to personal computer software and hardware production and then to web-based e-commerce industries.
2. Cluster-based strategies are only applicable to small, specialized firms because of the level of trust and cooperation required for a successful cluster. Bergman and Feser (1999) counter that the reliance on nonspecific concepts such “trust and cooperation” is overstated for successful cluster development. A cluster comprised of enterprises that gain no real economic self-advantage has little practical meaning. Larger companies will participate if they see personal economic benefit from participating in the buyer-supplier relationships, common technologies, common markets, common distribution channels, and common labor pool offered by a given cluster [43].
3. New telecommunication and Internet technologies are replacing the need for spatial clustering, and firms may no longer receive competitive advantage from close geographic proximity. However, most evidence suggests electronic interchange is not likely to replace the importance of face-to-face communication. Competitive advantage gained from cooperation between buyers and suppliers relies on informal business and social exchanges.
4. Cluster initiatives may apply to only large urban areas, while the vast majority of cities and regions have little prospect for developing more than one or two viable clusters. Rosenfeld (1997) argues that clusters can stretch over larger geographic regions if industry leaders are willing to travel longer distances to gain the benefits of interaction and collaboration [44].
5. Some economists feel government intervention in economic development distorts the “market” through inappropriate forms of public ownership and subsidies [45].

6. Some industries simply cannot take advantage of proximity benefits offered by clusters. Examples include industries especially intensive in just one or two specific factors (e.g. coal or timber) or one or two general factors (e.g. labor or capital) [46].
7. The value and sustainability of a regional cluster could be undermined if it is dominated by a small number of very large companies that report to distant headquarters. This ties the success of a cluster on strategic decisions made at a distance from its economic infrastructure and in turn, less innovative and more at risk over the long-run. Proponents of clusters suggest that the corporate restructuring, downsizing, and reengineering counter this risk as more companies are giving decision-making responsibilities to branch plants. Furthermore, key leaders in branch plants are often committed to a region [47].

2.6 Linking Transportation to Clusters

The previous sections have established the notion of regions and the link between competitive advantage and economic development policy. Because industrial clusters represent an important, and currently fashionable, policy approach to competitive advantage, transportation infrastructure and service providers and planners have a need and responsibility to understand their connection to industry clusters. Listed below are integration points for transportation infrastructure and service within the competitive advantage cluster framework.

Transportation as a Factor Input in the Diamond Competitive Framework

Transportation systems and infrastructure are factors (or inputs) to the competitive diamond framework, and impact the overall conditions of the system. The quality, cost, and efficiency of the transportation infrastructure factor are critical forces in the competitive dynamics. Effectively improving the transportation infrastructure by eliminating cluster-specific inefficiencies will contribute to cluster productivity growth.

Transportation firms, cities, and metropolitan areas in the U.S. are developing elements of this approach, but nowhere has the entire system been integrated to support cluster initiatives. In 1993, U.S. companies spent more the \$670 billion (greater than 10% of GDP) on logistics (packaging, loading, transporting, unloading of goods) in what many industry associations consider an inefficient infrastructure system. The grocery industry alone estimated it could save \$30 billion (or 10%) of its logistic costs with a more efficient infrastructure. In California, more than 300,000 work hours each day are lost due to highway traffic congestion alone [48].

Social infrastructure, including quality of life issues, is important for clusters. Cluster firms will find it easier to attract top-quality people if the quality of life in a region is seen as high. As clusters flourish, the success of the clusters may ultimately causes strain on the region in which cluster-based economic development occurred . For example, the quality of life in Silicon Valley is seen as diminishing in part due to high levels of congestion and long commuting times. Transportation infrastructure and planning play a key role in alleviating the strains on the dynamic metropolitan system caused by the growth of a successful cluster.

Transportation as a Means of Supporting other Competitive Diamond Inputs

Access to a skilled labor market is another important factor condition for the competitive dynamics of an industry cluster. The greater the efficiency with which a region provides this access, the more able its industries will be able to create and sustain productivity growth. Rapid and efficient long-distance transportation services can link a region to a larger, and more diverse labor market. In New England, I-95, a commuter rail connection, and perhaps even Acela, the new high-speed rail service, has linked the Providence and Boston labor markets creating regional access to a larger skilled labor market in New England. This is especially important in regions such as New England where the workforce population growth in metropolitan areas is stagnant, if not in decline.

Transportation as a Key Economic Infrastructure Component

Cluster competitiveness derives from its economic infrastructure – infrastructure that provides access to highly specialized economic inputs that are not usually provided solely by the business sector. In defining the boundaries of a regional cluster, political and geographical borders are not appropriate. Instead, the cluster boundary is defined by the extent, reach, and efficiency of its economic infrastructure (see Figure 2-4). An understanding of this economic infrastructure is especially important in the Diagnosis phase of the cluster-development framework presented in Section 2.5.3. In this phase, regional economic infrastructure, such as transportation, is benchmarked by determining whether the region is providing the clusters with the necessary economic inputs needed to support and create competitive advantage.

Transportation as a Key Stakeholder in a Cluster-based Initiative

In the mobilization phase of the cluster-development framework, key stakeholders assemble for the mobilization and collaborative phases based on recognition of shared needs and negotiation of

shared commitments. Transportation cluster-input representatives to a cluster (see Figure 2-8) include economic infrastructure providers such as air, rail, road, and port facilities and services; and economic infrastructure intermediaries such as regional transportation planning agencies.

Transportation as a Facilitator of Innovation

Clusters rely on innovation in order to develop and sustain a competitive advantage. Many regard the effect of transportation investments as “energizing” innovations in non-transportation sectors, also known as companion innovations. Social and economic advances then follow. Transportation investments energize, rather than create innovation because of transportation’s enabling role, as it opens opportunities to do current practices better, or facilitates the creation of new practices altogether. Garrison and Souleyrette (1996) give an example using the expansion of the U.S. road network and food retail distribution in the mid-twentieth century. Average square footage of new supermarkets increased from 7,000 in 1940 to 20,000 in the 1960s. Increased store size was permitted by customer’s automobile travel and the automobile’s ability to transport multiple sacks of groceries (and other non-transportation related advances, including the increased use of home appliances such as the refrigerator). During that same period, consumer’s expenditures on food decreased from about 30 to about 20 percent of all expenditures, while at the same time, consumer’s had the advantage of greater variety of choices [49].

Innovation also relies heavily on face-to-face communication of collaborating and competing industries, the creation of a specialized network of buyers and suppliers, and the utilization of specialized labor pools. Transportation provides important support for each of these components of innovation.

Transportation as the Facilitator of Collaboration Economies - JIT Linkages

Minimized inventory and reduced sourcing, production, and delivery cycles introduced through JIT linkages, lean manufacturing initiatives, and improved supply-chain management play a prominent role in manufacturing cluster dynamics. Multi-modal transportation systems are important, as clusters’ efficiencies rely on cross-docking transportation facilities that permit products to flow rapidly and seamlessly through highways, railways, seaports, and airports. Efficient ground transportation designs also need to incorporate redundant routes and intelligent transportation systems (ITS) to minimize the impact of congestion or accidents on connecting systems.

Providing Scenario-Specific Efficiencies for Cluster-based Initiatives

In Section 2.5.1, five regional circumstances were presented which often precipitate the need for a cluster initiative. Transportation services and infrastructure serve as the critical component in many of the resulting scenario-specific initiative actions:

- Connecting rural and smaller cities to larger metropolitan areas to create satellite nodes to developed, but distant clusters
- As a link between disadvantaged inner urban areas with economic opportunity in the greater metropolitan area
- Creating cross-border linkages in response to the reduction or elimination of trade barriers and boundaries
- Create new and diverse transportation links to attract and promote diversification and new uses for existing, but declining industries found in regions with a narrow and dependent economic base

Transportation as an Industry Cluster Itself

Transportation services and infrastructure themselves can make up an industry cluster. Industry, support services, and trade organizations may all concentrate in a geographic area to provide transportation-related functions. Examples include the: Alameda Freight Corridor in Los Angeles, a network of transportation services linking the Port of Los Angeles, manufacturing industries, and intercontinental rail distribution yards; Fed-Ex and the related services in Memphis, Tennessee; the shipping clusters in Singapore and Hong Kong; and the Miami cruise ship industry.

The preceding discussion has established the notion that economic development for a region is dependent in large part on the region's competitive advantage. Industry clusters play an important role in the growth and sustaining of this competitive advantage, and within a cluster-based economic development strategy, there are important roles that transportation infrastructure and investment can play. Subsequent chapters discuss linking the role of transportation investment and economic development strategy with that of regional transportation planning. The next chapter begins this discussion by reviewing the link traditionally attributed to economic development and transportation, and how transportation organizations typically incorporate economic development goals within their planning process.

Chapter 3. Transportation and Economic Development

There is a clear relationship between transportation and commerce. Delivery of business goods and services, household access to stores and consumer services, and worker access to jobs all depend on transportation facilities. As a result, decisions regarding investment in transportation facilities can impact the level, mix, and location patterns of economic activity. Recognition of the economic impacts of transportation is not new. Roman roads across Europe and railroads across the U.S. have long been used as examples of the role played by transportation infrastructure in economic expansion [50].

The link between transportation investment and economic development has broad ramifications that go beyond transportation's basic purpose of moving goods and people from one place to another. There is little doubt that transportation is essential to the operation of any economy, but much still needs to be understood about ways in which a transportation system can impact and improve a regional economy. The chapter begins by differentiating between economic growth and economic development. Next, an overview of previous research into the link between economic development and transportation is cited, along with a summary of a new study by two transportation economists released in 2000. A brief assessment of the state-of-the-practice of incorporating economic development within transportation planning is made, followed by a discussion regarding the various methods by which the economic impact of a transportation investment can be measured. The chapter concludes by revisiting the role that transportation might play in the development and growth of industry clusters.

3.1 Economic Development: A Working Definition

3.1.1 Economic Growth versus Economic Development

Like the concepts of clusters and regional competitive advantage, the term “economic development” is often vague and not well understood. The complexity of the concepts encompassed by the term does not provide for a simple definition.

Economic development agencies typically seek to increase economic activity by increasing their area's business expansion, retention, new-starts, and attraction. To accomplish this, they generally work to encourage projects or programs that will: (1) reduce business operating costs and increase business productivity; (2) expand the size of business markets; (3) increase business

access to needed labor, supplies, services, and materials; and (4) promote the advantages of their area. As was discussed in the previous chapter, cluster-based development strategies are currently one of the prevalent ways economic development agencies employ to increase regional economic activity. Despite an increasing recognition of economic development impacts as an issue to study, the meaning of economic development remains multifaceted. The terminology used in practice is often unclear and even inconsistent. In particular, the measurement of economic development is often referred to as “economic impacts” leading to confusion between it and the broader study of social benefits and costs. Even more common is the interchangeable use of economic development and economic growth, two related but not necessarily identical terms.

Economic development is fundamentally concerned with enhancing the factors of productivity – labor, land, capital, and technology - for a local, regional, state, or national economy. The public sector has often been responsible for setting the stage for employment-generating investment by the private sector. In doing so, the public sector generally seeks to increase incomes, jobs, or productivity of resources in a particular region. However, there can be trade-offs between economic development’s goals of job creation and wealth creation. Increasing productivity, for example, may eliminate some types of jobs in the short-run.

Economic development encompasses a wide range of concerns. To economists, economic development is an issue of economic growth, measured principally in terms of measurable change in income, employment, or gross regional product (GRP). To business leaders, it may simply involve the wise use of public policy that will increase competitiveness. To people who think government should be directly active in the economy, economic development may be seen as interchangeable with industrial policy. Vaughan and Bearse (1981) define the difference between economic development and economic growth as follows [51]:

Economic Development: A *qualitative* change which entails changes in the structure of the economy, including innovations in institutions, behavior, and technology.

Economic Growth: A *quantitative* change in the scale of the economy – in terms of investment, output, consumption, and income.

Defined this way, development is both a prerequisite and result of growth. Development is prior to growth in the sense that growth cannot continue long without the sort of innovations and structural changes that are the result of development. But growth, in turn, will drive new changes

in the economy, causing new products and firms to be created as well as incremental innovations. Together, these advances allow an economy to increase its productivity, enabling the production of more outputs with fewer inputs over the long haul. For the purposes of this thesis, Vaughan and Bearse's differentiation between growth and development will be used, as their definition for development is analogous to the competitive advantages dynamics which manifest themselves in a region through its working industry clusters.

3.1.2 Transportation Infrastructure Defined

Before discussing the link between transportation infrastructure investment and economic development, it is first necessary to more precisely define the term "infrastructure." Infrastructure can be defined as the durable capital of a region; its location is fixed. Annual expenditure on infrastructure in the United States is significant. In 1990, the United States spent \$113 billion on all categories of infrastructure, including \$70 billion on highways, bridges and mass transit; \$19 billion on water supply, \$9 billion on airports and aviation, \$8 billion on water resources, and \$7 billion on disposing solid waste. The annual infrastructure outlay is equivalent to 6% of all government expenditures, equaling approximately \$400 per person. Although infrastructure spending is non-trivial, as a percent of GNP, it has declined over the past decades falling from 2.3% of GNP in 1967 to 1.7% in 1990 [52].

Transportation infrastructure includes canals, ports, railways, airports, communications (e.g. air traffic control), roads, and terminals. Transportation facilities, services, systems, and networks are all considered under the broad category of transportation infrastructure for the purposes of this research. Two basic methods are used to evaluate the adequacy of transportation infrastructure: an engineering approach and an economic efficiency approach. The engineering approach evaluates two qualities of the transportation infrastructure: (1) the extent to which it incorporates the state-of-the-art technology and design, and (2) the extent to which it performs intended functions according to standards of reliability, durability, safety, mobility, and accessibility. In the economic efficiency approach, the focus is on the degree to which the transportation infrastructure enhances the productivity of the private and public sector. For example, treating the economy as if it were a single large company, an economist could gauge the extent to which total output could be produced less expensively with a different mix of inputs, and specifically with a mix that includes either a larger quantity, better quality, or both of transportation infrastructure.

Banister and Berechman (2000) identify six characteristics of transportation infrastructure [53]:

1. Transportation infrastructure involves delivery systems allowing the provision of services to individual customers.
2. Transportation infrastructure usually has substantial elements of a natural monopoly.
3. Transportation costs may form a small but important part of the total costs of the products in which they are used. The losses that result from infrastructure service failure are often very substantial relative to the basic cost of the service provision.
4. The sunk costs of establishing transportation infrastructure are substantial. A high proportion of the total cost of the transportation service has been irreversibly incurred before it is actually offered to customers.
5. Initially, the capital costs of transportation infrastructure are large relative to operating costs.
6. In the United States and Europe, most investment today is being channeled into replacing and upgrading existing infrastructure rather than into new infrastructure.

Having defined economic development and infrastructure, we now move into a discussion of the role of transportation in economic development.

3.2 Previous Research

An on-going study at MIT has explored the role and impact of transportation investment on economic activity [54]. Abel Muñoz-Loustaunau (1998) summarized the previous research to date and his findings are presented in the following sections [55].

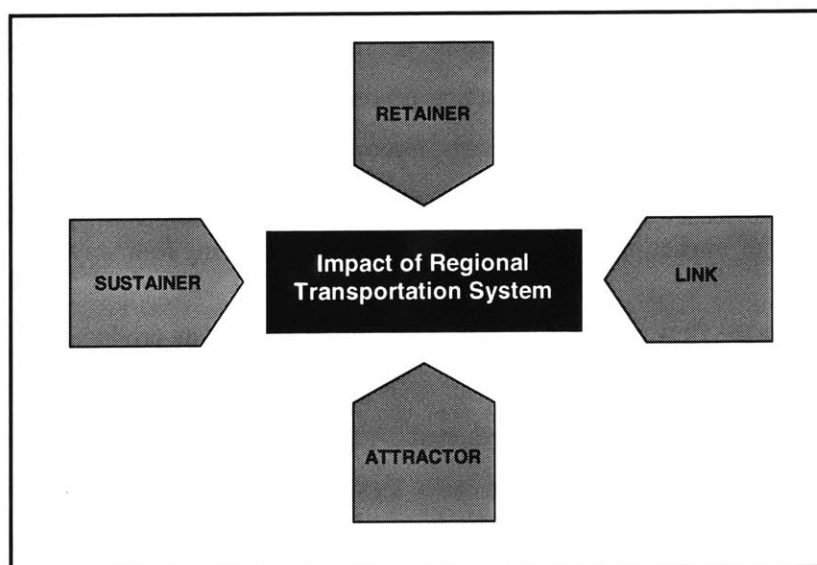
3.2.1 The Basic Roles of Transportation

Muñoz-Loustaunau explains that transportation is not an end unto itself, but is instead primarily a derived demand for other purposes. Although it is intuitively felt that investment in transportation infrastructure has a relationship to the economic activities of a region, it is difficult to establish the exact nature of this relationship due to the complexities involved. General agreement as to the relationship is found when looking at the extreme conditions. The impact of the transportation investment will be greater where there are few or no routes, and smaller for a well-networked region.

To understand the magnitude of the impact, Muñoz-Loustaunau argues that the effect will be dependent on the condition of the regional economy. He categorizes four basic roles that transportation can play into a conceptual framework to evaluate the transportation system in a region:

1. Transportation investments may be needed to avoid the deterioration of existing infrastructure, and support or facilitate the flow of persons and freight being generated by current economic activity. In this role, transportation *sustains* the present economic activity. Investment in transportation infrastructure will generally follow and catch-up to regional economic growth.
2. Transportation investments may be needed in response to demand from expected economic expansion. In this role, transportation acts to *retain* the present economic activity. Investment in transportation infrastructure will precede growth and may function as a prerequisite for it.
3. Transportation investments are a means to provide an interconnected network for a region that offers attractive services to expanding or relocating firms. In this role, transportation acts to *attract* new economic activity.
4. Finally, transportation can physically *link* a region to the global economy.

Graphically, the framework may be presented as shown below in Figure 3-1:



Source: Muñoz-Loustaunau, 1998

Figure 3-1: Basic Roles of Transportation

To apply the framework for evaluation of a regional transportation system, Muñoz-Loustaunau gives the example of a regional goal that includes linking its economy to an established trade flow. In this case, the state of the regional transportation's physical linkages such as airport or seaport systems should be evaluated.

3.2.2 The Basic Impacts of Transportation

Muñoz-Loustaunau expands the economic development evaluation framework by conceptualizing the three basic impacts of transportation investments in a regional economy. The first is the *Corridor Effect*, where infrastructure does not impact the region internally, but impacts the through traffic. The second basic impact is the *Crossroads Effect*, where infrastructure improves the links from and to the region. Finally, the third basic impact is the *Productivity Effect*, where infrastructure improves regional productivity by reducing transportation costs within the region. Based on the discussion of competitive advantage, clusters, and transportation in Chapter 2, a fourth basic impact is proposed here: the *Dynamic Effect*, where infrastructure impacts structural changes in the regional economy necessary for sustaining a region's clusters and competitive advantage.

3.2.3 The Impact of Intelligent Transportation Systems

Muñoz-Loustaunau completes his summary of the relationship between economic development and transportation investment by exploring the impact of Intelligent Transportation Systems (ITS). He recommends that transportation planners need to more seriously consider ITS investments during the transportation planning process and assess the ability of the technology to stimulate and sustain economic development. According to Muñoz-Loustaunau, although ITS, as an economic tool, has not yet become a common component of regional transportation plans, it holds the promise of impacting regional economies in the following four ways:

1. Improving the flow of goods through a region, improving its productivity
2. Reducing congestion on connections to regional economic activity centers, the links to the global economy can be strengthened
3. Substituting capital expenditures with less expensive operational improvements frees funds for investment within the regional economy for other projects supporting economic development
4. Extensive use of private sector ITS technologies can provide a new market for regional industries, possibly generating job growth in the future

3.3 “Necessary Conditions” for Economic Development

In 2000, David Banister and Joseph Berechman released a study assessing the link between transportation infrastructure investment and economic development. The authors argue that political and institutional factors provide the broader context in which transportation investment decisions are made. Their findings are presented in the following sections.

3.3.1 New Themes of Transportation Infrastructure Investment

In the 1990’s, five main themes regarding transportation infrastructure investment and economic development emerged in the United States and Europe [56]:

1. The lack of investment in infrastructure of all types (including transportation) is having an adverse effect on efficiency and productivity.
2. Attempts are increasingly being made by economists and planners to identify under what conditions measurable development effects can be identified.
3. Environmental arguments have emerged as a significant consideration.
4. Industry’s general view is that competitiveness is being jeopardized by a lack of investment in regional infrastructure. With congested transportation networks, product distribution has the risk of becoming increasingly unreliable.
5. The concept of induced traffic became mainstream with the recognition that economic values of road infrastructure investment can be either under- or overestimated by the omission of induced traffic volumes.

The themes illustrate that transportation investment are increasingly being regarded as part of a broader system. Sussman (2000) terms these broad systems as CLIOS, or Complex, Large-Scale, Integrated, Open Systems [57]. Within this framework, the infrastructure investment-development system is *complex* as the degree and nature between economic development and transportation infrastructure is imperfectly known, and difficult to predict. The impact of a CLIOS system is manifested over a *large-scale* geographic area, which is appropriate given the regional scale of competitive advantage and economic development. The feedback loops between the points on Porter’s competitive diamond (see Figure 2-1) *integrate* factor inputs, including transportation infrastructure, with the other competitive diamond subsystems. Finally, to properly assess any transportation investment, it must be done within an open system, with respect to economic, social, and political aspects [58].

3.3.2 A Weakening Link between Transportation and Economic Development?

Historically, with few links in a regional transportation network, the impacts of investment could be easily identified and casual relationships inferred. Assumptions were made that a high quality transportation infrastructure was an essential prerequisite for economic development and growth. This assumption has not been rigorously tested, despite becoming a common rationale for investment decisions. Traditionally, transportation investment was popular with the public as it allowed them to develop and maintain a mobile lifestyle. Transportation investment was also traditionally popular with industry, which often argued that new or improved infrastructure would make them more competitive and allow for job growth [59]. For developing countries, these casual relationships may still hold. The World Bank's position on the link between transportation investment and development is clear:

“Transport is central to development. Without physical access to jobs, health, education, and other amenities, the quality of life suffers; without physical access to resources and markets, growth stagnates, and poverty reduction cannot be sustained. Inappropriately designed transport strategies and programs, however, can result in networks and services that aggravate the condition of the poor, harm the environment, ignore the changing needs of users, and exceed the capacity of public finances [60].”

For more advanced economies, where transportation infrastructure is already well-developed and more complex markets are in operation, a key question emerges: are the same arguments for linking transportation investment and economic development still relevant? Banister and Berechman believe new priorities are present in developed, regional economies that cause many of the traditional arguments to be weakened, or to even no longer apply. These new priorities include: (1) transportation investment increasingly viewed as a process with strong political, social, and environmental implications; (2) flexible location decisions by the public and industry create patterns of interactions and travel which are more complex; (3) new economic forces at work as regional economies move from manufacturing-based to ones based on service and information industries; and (4) a changed demographic profile of the population, with increased life expectancy and new household structures [61].

Even as the impact of geography and transportation costs regain credibility with mainstream economists for explaining economic growth, Banister and Berechman claim the importance now allocated to transport costs is too great and question the degree to which a firm's competitiveness will improve from transport cost reduction. Their research indicates that transport costs are

increasingly a smaller part of total production costs, yet it seems to have been given a disproportionately large role in explaining the competitive advantage and location decisions of firms [62]. However, if transportation costs are considered more broadly within the total logistics costs for firms, their competitive impacts increase in importance.

Using case studies drawn from road, rail, and airport investments in North America and Europe, Banister and Berechman investigated the appropriateness of seven recent assumptions of the relationship between economic development and transportation infrastructure. The seven assumptions and the basic findings from their research are shown in the table below. Section 3.3.3 provides a summary look at the findings from the modal case studies.

Transportation & Development Assumption	Findings
The growth impact of any new transportation facility will be significant.	<i>Maybe.</i> Most networks in developed countries are well-connected, so the impact of any new link is likely to be small individually, but the combined effects of new links may be substantial
Transport costs are a declining part of total production and labor costs	<i>True.</i> Contribution of transportation costs is likely to fall even further as service and information based employment increases
Vibrant economic conditions are more important than infrastructure	<i>True.</i> Transportation infrastructure can enhance this factor but not substitute for it
Unique regional characteristics over which the development impacts are to be felt are an important consideration.	<i>True</i>
Results from specific case studies on the link between transportation investment and economic development can be generalized	<i>A cautious "Yes"</i>
The role of technological change in impacting the relationship between economic development and transportation investment is known.	<i>Unclear</i>
It is possible to assess the course of economic development in a region in the case that a given transportation investment is not made.	<i>Unclear</i>

Adapted From: Banister and Berechman, 2000

Table 3-1: Key Assumptions and Findings

3.3.3 Road, Rail, Airport, and Transit Impact Findings

Banister and Berechman investigated several case studies regarding recent investment in highway, rail, and airport infrastructure and its impact on the associated region's economic development. Their findings are summarized briefly below, and supplemented by additional findings for transit service investment.

Road Investment

Banister and Berechman found most recent road investment have taken place in specific corridors where development has been encouraged, or in locations between and around cities to expand the inter-urban network. Justification for most of the road cases examined, including the London ring road M25, was based on a link between transport investment and economic activity or development. Yet, in each of the cases, the critical role of policymaking and its interaction with existing economic conditions was not clearly identified. Most quantitative analysis was focused on determining the cost savings in terms of travel times, with minimal to no attempt to quantify economic impacts [63]. Additionally, Muñoz (1998) has looked at the U.S. Interstate Highway System, and made the following conclusions regarding highway investments [64]:

1. Highway investments are generally able to produce positive effects on the economy, but since this does not always happen, it suggests that other factors within the regional economy must be taken into consideration.
2. The rate of economic growth and development varies over time, and depends on the location of the highways. Investment in interconnected highway investment generally generated better results than local, relatively unconnected roads.
3. Although U.S. productivity growth benefited from the interstate highway investment, the transportation infrastructure's impact was second order. The main factors of productivity growth were related to other factors such as growth in population.

Rail Investment

The researchers found that investment in rail systems have often been justified not only based on cost-benefit analysis, but also by broader employment and development benefits. In fact, many of the investment decisions would not have been considered if only the transport benefits were used. Several projects were examined, including the Japanese Shinkansen, and the French TGV. Banister and Berechman suggest that rail investments do not act as the primary catalyst for economic change, but they can act to reinforce change that is already or likely to take place.

Airport Investment

In examining the role of airport investment and development, Banister and Berechman found that airports with similar volumes of traffic could generate significantly different economic impacts based on their traffic mix. An important determinant of traffic mix was the size and diversity of the regional economy. To identify the precise contribution of airport investment to a region, Bannister and Berechman propose a four-step analysis process [65]:

1. Analyze the structure of the region's economy, together with the role that the airport plays within it. The authors characterize an airport by type and traffic mix in an effort to assess the role airport investment can play as shown below in Table 3-2:

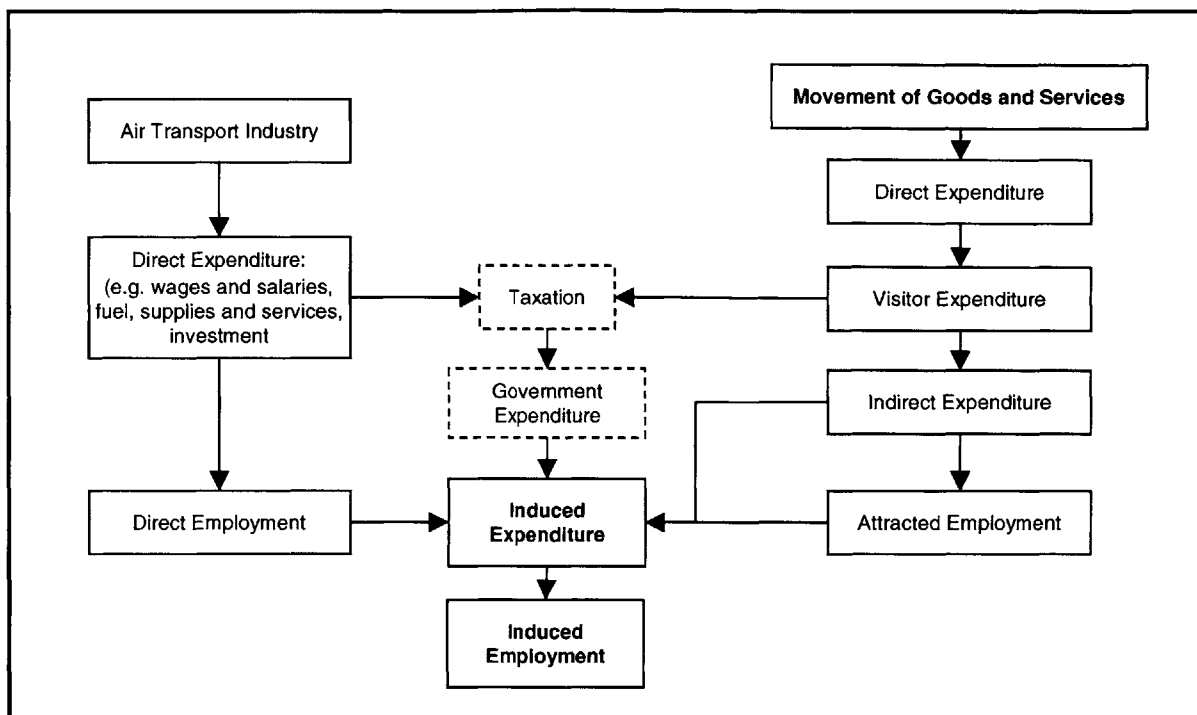
Airport Type	Passengers (millions/yr)	Traffic Mix	Economic Impact Characteristics	Examples
International Gateway	> 15	Designated gateway or continental scheduled services. Full range of scheduled services. Charter. Freight. General Aviation. Maintenance	Attracts international company HQs and distribution centers. Large-scale retailing centers. Long-haul tourism. Exercises economic influence nationally and internationally. Extensive off-airport influence.	Heathrow, Amsterdam, Paris CDG, JFK / SFO, Chicago, Atlanta
National Hub	3 - 15	Important national interlinking role	National based airlines. International airfreight. Important national firms. Capital city tourism	Rome, Oslo, Zurich
Regional Airports	0.1 - 12	Can serve specialist markets. May exercise an important international role.	Supports high-value export oriented industry. High frequency scheduled passenger services	Milan
Tourist Generator	1 - 20	Specialize in high volume of leisure charter flights. Supplemented by scheduled flights. Some cargo flights	Large-scale maintenance operation. Important commercial trading	Gatwick, Manchester
Tourist Receiver	1 - 12	Specialize in handling inbound charters	Essential focus for inbound tourism. Center for ground handling. Opportunity to establish a supply network	
Transit and Interline	Varies	Long-haul scheduled services with interline operations	Attracts stop-overs. Duty free trade and trans-shipment depot. Important cargo and shipping operation	Anchorage

Adapted from: Banister and Berechman, 2000

Table 3-2: Airport and Economic Impact

2. Isolate and analyze the significance of each airport infrastructure variable that supports the regional economy.
3. Assess the economic impact of the airport business in terms of the different types of employment and purchasing.
4. Evaluate the social aspects, given the airport investment's potential impacts on the wider labor market and cultural activities within the region.

The framework proposed for airport evaluation is graphically shown in Figure 3-2:



Source: Banister and Berechman, 2000

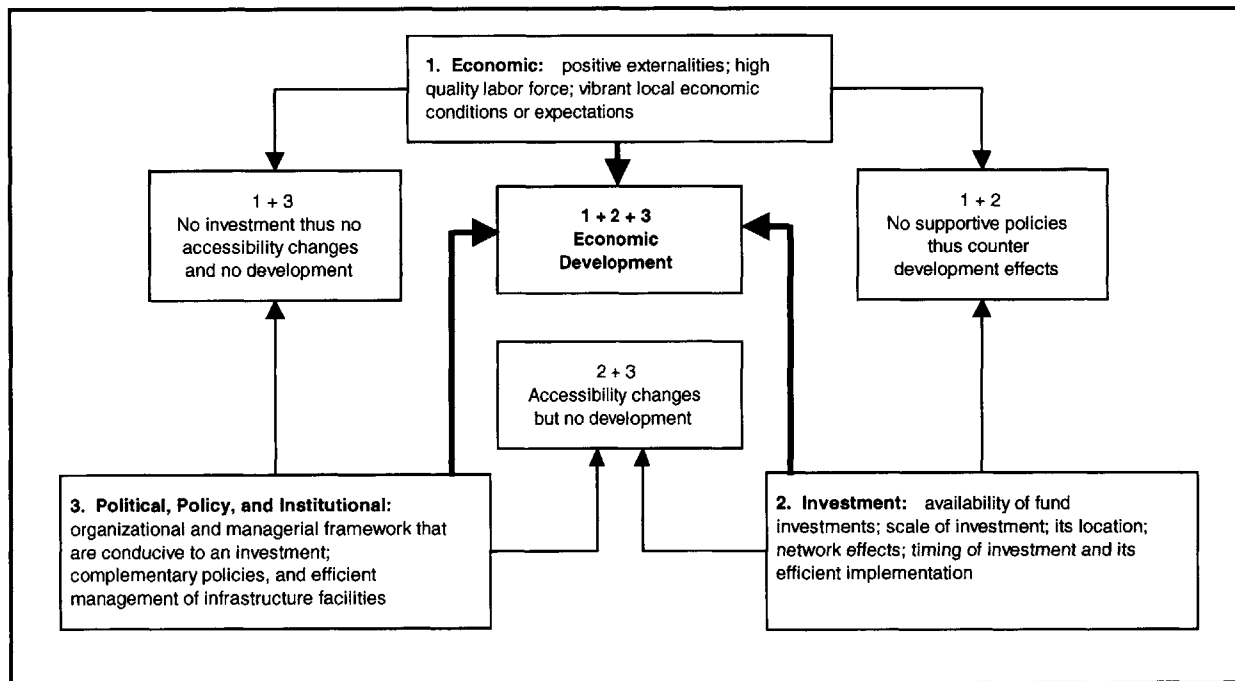
Figure 3-2: Airport Impact on Economic Activities

Transit Investment

Public transit can impact the location and intensity of physical development within a metropolitan region, but its ability to influence physical development does not necessarily imply economic development for the region as a whole. Despite frequent claims that construction of a transit system will produce economic growth, Huang's (1995) extensive survey of the literature identified only *two* empirical studies which attempted to systematically measure economic growth impacts, and significantly, no studies measuring economic development. Each study reached opposite conclusions. One study, the impact of BART on the San Francisco Bay Area, found no significant effects on economic growth, while a study on SEPTA found large, long-term effects on regional output, employment, and income. The BART study methodology treated economic growth as a single variable, without recognizing the complexities of the economic development process. The SEPTA study directly translated travel time and congestion reductions into increased economic growth, another questionable methodology [66]. Without further empirical studies on transit's impact on economic development, it is difficult to reconcile the conflicting conclusions from these studies.

3.3.4 The Three Necessary Conditions for Economic Development

Bannister and Berechman found that in developed countries where there is already a well-connected transportation network, further investment in that infrastructure would not on its own result in economic growth. Transportation infrastructure acts as a complement to other, more important underlying conditions, which also must be met if further economic development is to take place. Transport investment is not the sole *necessary* condition for economic development, but acts in a supporting role with other factors at work. This same argument can be made for almost any type of infrastructure investment, not strictly transportation, but it is useful to explicitly restate this argument because so many large-scale transportation investments are largely justified on the simple notion of “promoting economic development.” Banister and Berechman claim the three sets of necessary conditions required for development to occur with infrastructure investment are: (1) economic conditions, (2) investment conditions, and (3) political, policy, and institutional conditions. The illustration of necessary conditions is found below in Figure 3-3:



Adapted from: Banister and Berechman, 2000

Figure 3-3: Necessary Conditions for Economic Development

The concept illustrated above expands Muñoz-Loustaunau’s framework for the basic role of transportation. The framework demonstrates that individually, the necessary conditions will have little or no impact on economic development. Even if they are combined in pairs, their effect will

be limited. It is only when all three necessary conditions are present and working together that economic development from transportation investment will follow. The goal of Chapter 6 will be to expand the ReS/SITE framework so that its structure may explicitly take into consideration these three necessary conditions.

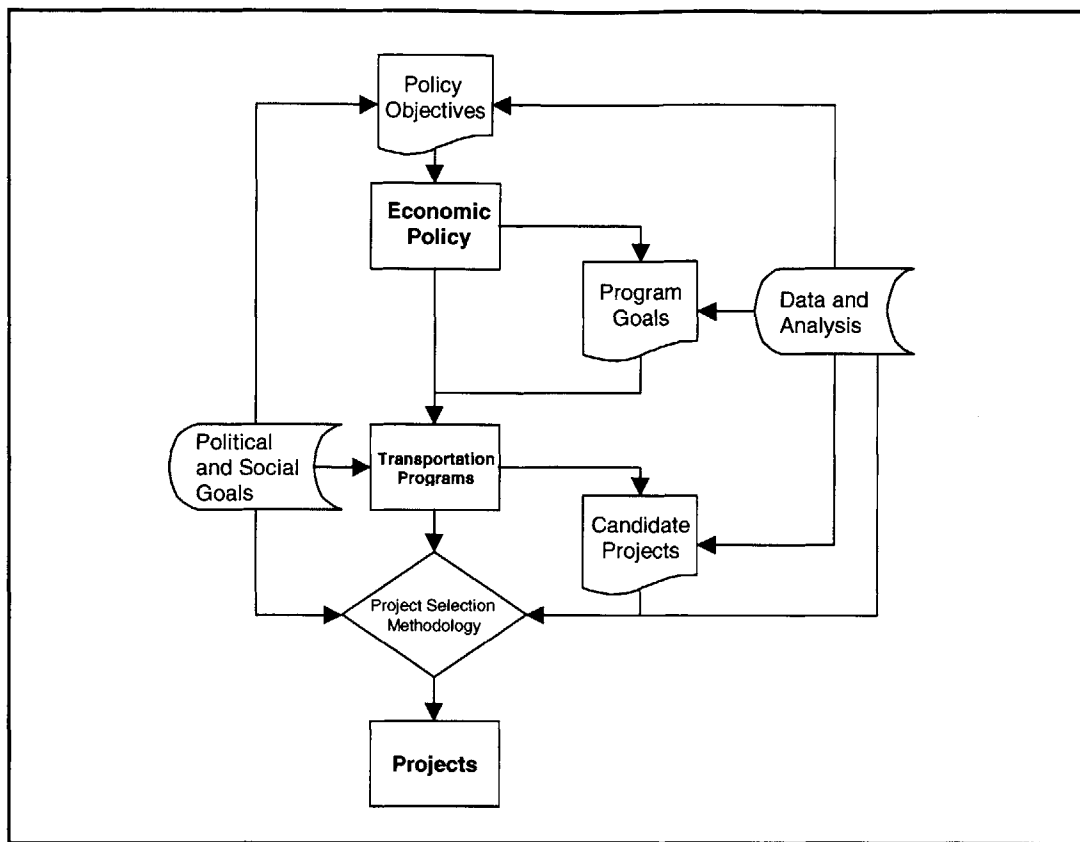
Having addressed the conditions required for economic development, the following section explores the state of the practice for incorporating economic development issues within transportation planning.

3.4 Transportation Planning and Economic Development Policy

Transportation planners face complex questions when planning for transportation investments. These questions are often circular, as planners are often asked: (1) what are the transportation needs for future growth, and (2) what will be the effect of transportation investment on future economic development. Transportation investment can take two distinct paths: infrastructure expansion and infrastructure enhancement. Expansion includes the construction of additional highway segments, rail lines, runways, or additional terminal capacity using traditional technologies. Enhancements refer to new technologies that can improve the efficiency of existing systems, examples of which include ITS, intermodal facilities, GPS, and air traffic control systems. As transportation systems mature and competition for federal and state funding intensifies, the questions have become more difficult. No longer is it a question of where to build another segment of highway, or which airport needs expansion. Instead, transportation agencies are facing increasingly complex pressures for prioritizing and selecting transportation projects.

3.4.1 The Transportation Investment Decision Hierarchy

The transportation decision-making process in the context of economic development policy is typically portrayed as a top-down decision-making process which evolves from policy, to program, and finally to project evaluation and selection. The hierarchy is shown in Figure 3-4:



Adapted from Weisbrod, 1999

Figure 3-4: Transportation and Policy Decision-Making Hierarchy

The *economic policy* defines the general aim or outcome of the planning process, while the program assembles the resources together to implement these aims. At the policy level, decisions are made about the objectives of the transportation infrastructure and system integration. Transportation economists argue that good policy in the transportation sector should have the same basic objectives as regional economic policy in general, though in practice, this is often not the case. Given the policy objectives, *program design* is oriented toward identifying and screening the most relevant and efficient project alternatives as well as for measuring and assigning the benefits and costs. The *project selection methodology* moves the process from policy toward concrete action and implementation. At every stage, information and socio-political considerations play a role. The advantage to this type of hierarchy is that programs and projects that are incompatible with the economic policy objectives are theoretically shed early. This is in concept only. The reality of the transportation decision-making process is often quite different.

Transportation planners often face many constraints or political realities within this decision-making process which in practice leads to a much different process. Some of these influences include:

- Constitutional and legislative constraints as transportation funds are often earmarked for specific spending purposes or restricted in scope of use, such as airport passenger facility charges
- Income redistribution goals where transportation policy is used as a way to beneficially affect the cost of living of elderly and low-income households
- Financing consideration constraints
- Funding environments where it is often easier to politically build new facilities than to implement demand management of existing facilities
- Social planning constraints in which transportation policy is intertwined with policies toward the environment, land use, urban renewal, and so forth
- Power constraints in which decision-making authority is not effectively placed

Because of these political realities and constraints, the state of the practice of incorporating economic development policy by transportation agencies is different than suggested by the top-down hierarchy.

3.4.2 The State of the Practice

Economic development impacts are usually assessed by transportation agencies only for large infrastructure projects. For highway and transit projects, these are likely to be major system improvements, such as new or expanded highway or transit lines. For other modes, these projects tend to be specific terminals such as airports, seaports, or intermodal facilities. Economic development analysis is done less commonly at the state or regional level for entire spending programs or for incremental improvements. The number of agencies, such as Metropolitan Planning Organizations (MPOs) and state Department of Transportations (DOTs), with a policy of formally including economic development analysis as a regular component of their project evaluation is small.

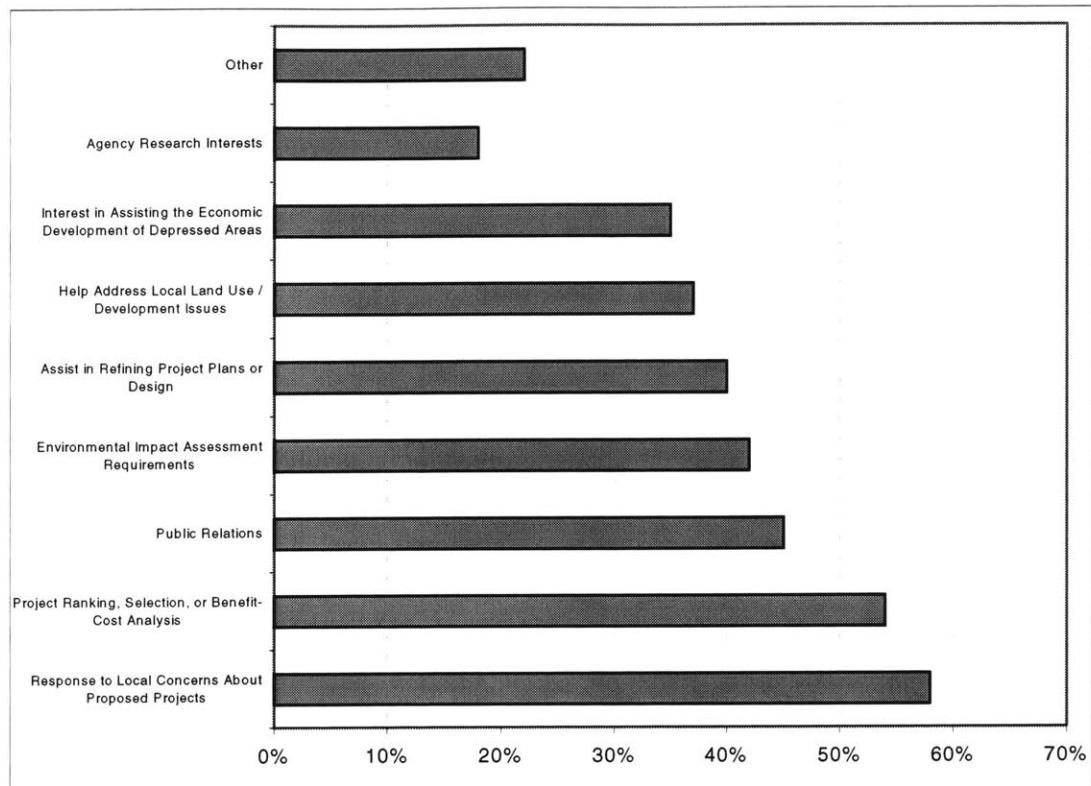
Most transportation agencies at the state and national level recognize economic development as an important consideration for some of their transportation investment decisions. However, most

agencies only sporadically conduct detailed studies. Such studies are usually undertaken only for large investments or for situations where concerns about economic development impacts emerge as a major factor.

There are several reasons cited for the small role played by economic development impact analysis for transportation projects. These include [67]:

1. Transportation agencies' need for a more validated link between transportation and economic development at the transportation corridor or facility level.
2. The need of more complete and transparent economic development analysis tools.
3. The development of more consistent standards or guidelines for agencies regarding how and when economic development impacts should be evaluated and measured
4. The lack of institutional links between transportation planning organizations and economic development policymakers

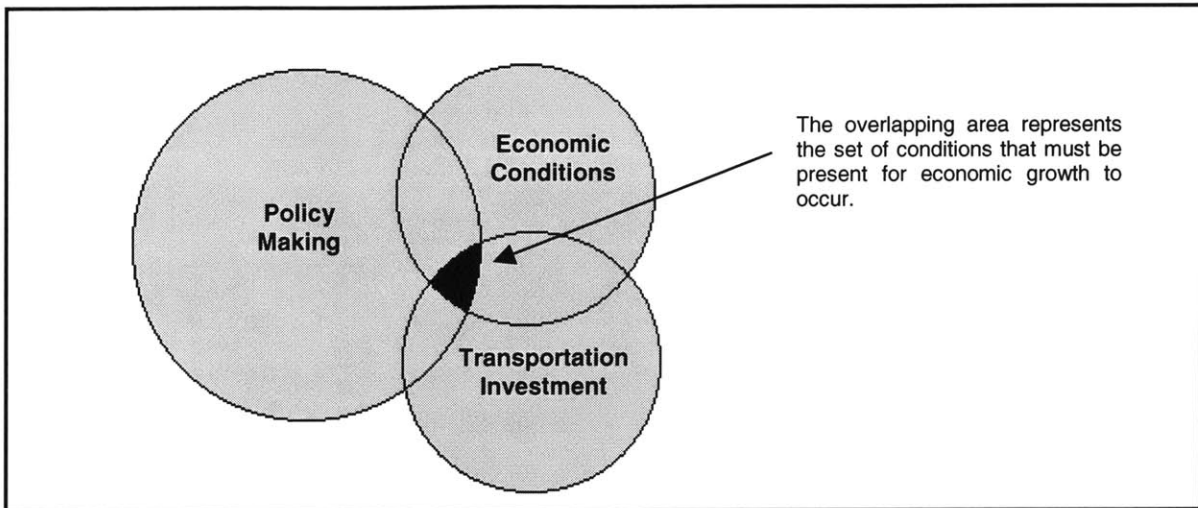
Weisbrod (2000) surveyed 52 transportation planning departments representing 36 states, 7 Canadian provinces, and 8 MPOs. He found that the motivations for specifically studying economic development impacts often had little to no relationship to specific economic development goals. The results, shown in Figure 3-5, show that more than one-half of all agencies reported having been motivated to study economic development effects as a response to local concerns about the adverse effects of proposed transportation investments, or as a factor in project ranking and selection.



Source: Weisbrod, 2000

Figure 3-5: Motivations for Studying Economic Development Impacts

Economic development goals need to be integrated within transportation more broadly than the survey suggests is currently being undertaken. Regional policy is an important consideration in any economic impact assessment of a transportation investment. Banister and Berechman cite the critical role of transportation and economic policy and how it influences and strengthens the potential impact of transportation infrastructure investment [68]. The three necessary conditions discussed in 3.3.4 may have conveyed the impression that each set is equally important. This is an incorrect portrayal of reality, since political and policy decision-making actually affects, directly, or indirectly, the other two sets of necessary conditions. The Venn Diagram in Figure 3-6 abstractly conveys the relationship between the three necessary conditions.

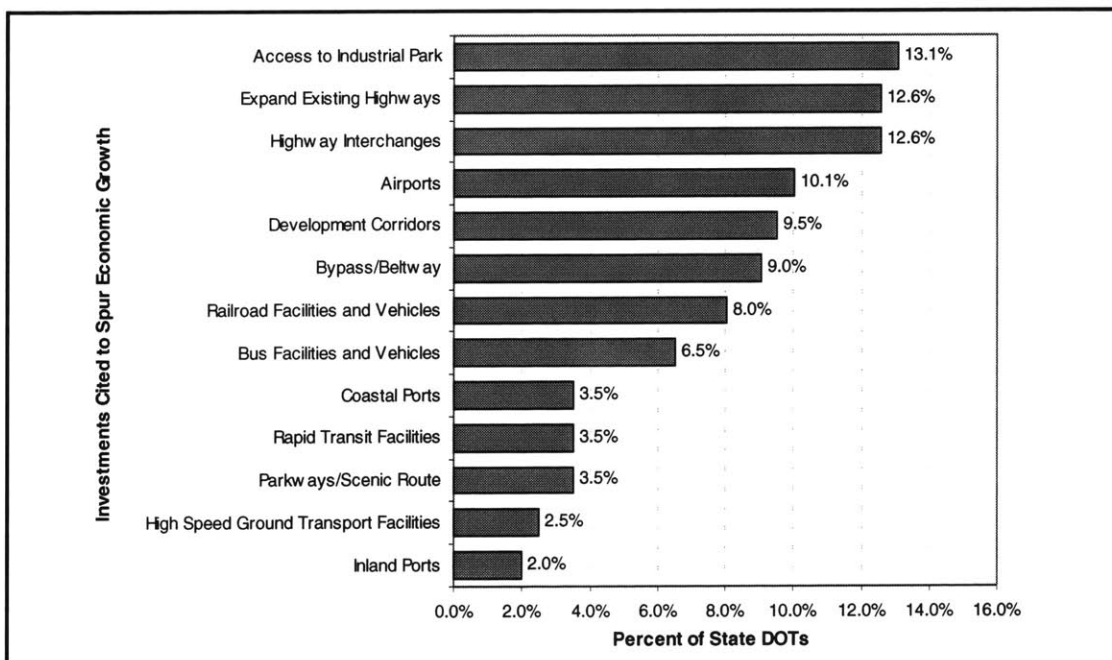


Source: Banister and Berechman, 2000

Figure 3-6: Relationship between Policy and Transportation Investment

3.4.3 Examples of Formal Studies

A survey of 40 state DOTs was made by Perkins (1992) [69]. When asked about which investments were made with the specific intention to spur economic growth, the most frequently cited investment was access to industrial park. The following figure shows which investments were cited by the DOTs. Only 28% of the respondents conducted economic evaluation of the infrastructure investment cited.



Source: Perkins, 1992

Figure 3-7: Investments Cited to Spur Economic Growth

In the cases where transportation planning agencies have a process for recognizing economic development impacts, they are often merely a set of procedures for recognizing the impacts, as opposed to formal policies. A few formal policies do exist, examples of which are given below:

TEA-21

The Transportation Equity Act of the 21st Century (TEA-21) provides for the federal funding of transportation investments and distribution of those funds between 1999 and 2003. It has played a significant role in raising the visibility of economic development as a component of transportation planning in the United States by explicitly identifying economic development considerations as one of several key factors in project funding decisions. The act sets forth a framework, jointly administered by the Federal Highway Department (FHWA) and Federal Transit Agency (FTA) for investment decisions made by the State DOTs and MPOs. One of the seven planning factors within the framework is to "support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency [70]." The other six planning factors within the framework – connectivity, accessibility and mobility, environment and quality of life, system management, system preservation, and safety – also have economic development impacts.

Louisiana Port Prioritization Program

Louisiana has a statewide system of prioritizing port investments between its eighteen river ports and six seaports. The program creates a process to evaluate all proposed investments based on their economic return for the state economy. Projects are ranked on the economic return to the state taxpayers. By requiring a state-wide perspective, the program avoids investing in port projects that simply relocate existing activity and focuses on statewide economic benefit [71].

Wisconsin Translink 21

The Wisconsin Department of Transportation adopted an investment strategy intended to provide a multimodal framework for evaluating economic priorities. Within the framework, alternative statewide transportation strategies were rated by how they would affect the state's key target industries. From this framework, the DOT created more detailed plans for a 25-year transportation plan. As part of this process, the DOT coordinates its strategies with local businesses and economic development organizations [72].

Montana TranPlan 21

The Montana DOT formally reviewed the state's economic development trends and issues and linked them to transportation issues in four areas: (1) rural access to outside markets, (2) economic diversification, (3) international trade, and (4) tourism. From these linkages, the department adopted a series of specific policies that promoted initiatives in each of these areas [73].

The World Bank

The World Bank evaluates specific transportation investments by considering a wide variety of factors including their potential effectiveness in reducing transportation costs for product distribution, improving economic linkages with rural and international markets, and improving worker access to jobs. The factors are subsequently used in constructing measures of expected social value and rates of return for transportation investments [74].

3.4.4 The Importance of Measurement

Having an economic policy as a consideration in transportation investment does not guarantee that economic development will occur. Furthermore, it is unclear how the benefits and impacts of the investment on economic development should be measured to evaluate the transportation project. The estimation and measurement of benefits of transportation infrastructure spending is important in three ways: (1) in establishing budgets and allocations, (2) in selecting among alternative projects, and (3) in selecting design alternatives. The next section will briefly explore several methodologies used to evaluate the benefits, and survey two frameworks in which represent two different ways of allocating benefits and assessing if the infrastructure investment will impact regional economic development.

3.5 Measuring the Impact of Transportation on Economic Development

The evolution of measuring the impact of infrastructure investment decisions has evolved over the last several centuries. Early business and government decision makers used the a rule of thumb approach which weighed the "pros and cons" of the alternatives. In the 1800s, Pareto offered a more structured framework with his "Pareto Principle" which was the notion that a decision was good for society if it made at least one person better off without impairing the well-being of others. The principal in practice was relatively unhelpful in that most projects create winners and losers. In the 1930's, Hicks and Kaldor offered a more applicable framework, the

“Hicks-Kaldor Principle,” which stated that a project was worth doing if the benefits exceed the costs and the “winners” could, in theory, compensate the losers [75]. This principle formed the basis of cost-benefit analysis (CBA), which has remained the most common form of measuring economic impacts. CBA has significant difficulties, among which are: (1) measuring the benefits of infrastructure that does not currently exist and will interact with other systems, (2) distributing the benefits and costs over time and discounting appropriately, and (3) incorporating measurement uncertainty.

In Chapter 1, Figure 1-1 depicted that transportation investment effects on economic development are usually measured in terms of the impact of a project or program on the growth of a region’s economy. Principally, it is measured in terms of change in output, gross regional product, personal income, and employment. Other, more important indicators focus on particular aspects of economic development impact, rather than overall expansion of a region’s economy. Strikingly, productivity, the most important measure for assessing regional competitive advantage, is found to be the least commonly used measure of a transportation investment’s economic impact. In general, economic growth is the focus of the measurements, not economic development.

3.5.1 Methods of Measurement

Economic development impact analysis is not typically viewed as a substitute for the evaluation of transportation systems; rather it is used as a complementary form of analysis. It is exceedingly difficult to determine how the benefits of a transportation investment can and should be measured. Over the past several decades, several types of economic analysis have emerged in an attempt to address this issue, each measuring benefits differently and pursued by different proponents. Each economic analysis technique will be briefly explored.

User Benefit Analysis

Nearly all major highway projects are justified and assessed by some calculation of user cost savings and its economic value. The benefits are measured in terms of improvement in travel time, travel expense, and safety, all expressed in terms of a money value. A common categorization of benefits will break out the benefits as shown below:

Trip Type	Benefit Type	Primary Area	Annual Impact (in Millions)	
			Rest of Region	Total Region
Work	Time	\$3.8	\$1.0	\$4.8
	Operating Cost	(\$0.4)	(\$1.5)	(\$1.9)
	Safety	\$1.2	\$0.6	\$1.8
Non-Work	Time	\$4.2	\$1.7	\$5.1
	Operating Cost	(\$0.5)	(\$1.9)	(\$2.4)
	Safety	\$1.8	\$0.8	\$2.6
Total		\$10.1	\$0.7	\$10.8

Table 3-3: Example of User Benefit Allocation

The methodology to compute these benefits typically involves traffic network models developed to represent origin-destination patterns. This methodology includes direct estimates of the full value of user benefits for all trips on the network. The disadvantage of this method is that it values only direct benefits to specific transportation users, and those benefits reflect only a limited set of direct costs, travel times, and accident costs. Dynamic externalities are ignored.

Regional-Economic Sector Benefit Models

Regional macro-economic models are increasingly being developed to make the traditional cost-benefit studies, exemplified in the user-benefit approach, more robust. The most frequently used regional forecasting model in the United States is the REMI (Regional Economic Model, Inc.) model. It is a dynamic model which has the ability to forecast over long periods of time, attempting to account for shifts in economic and demographic patterns in a regional context. At the heart of the model, the allocation of benefits from the transportation investment is allocated to different economic sector. Typically, for each business sector s , define:

$$A_s = B_s * C_s * D_s \text{ where:} \quad (3-1)$$

A_s = Dollars of total business benefit accruing to sector s

B_s = Total dollars of business activity in sector s

C_s = Percent of business activity in sector s spent on transportation related costs

D_s = Percent of total transportation activities by sector s that can benefit from improvement.

In addition to the business effects, market estimation models are used to assess opportunities for expanded business market boundaries, and the additional impact on attraction of tourism and business activity. Though this model accounts for transportation effects of cost savings and market growth, it places no value on activities of individuals that do not involve wages. No value

is placed on social, environmental, or quality of life issues, each of which has an impact on the competitive advantage of the region.

Qualitative Assessment Models

Qualitative assessment methods are sometimes used for economic development analysis of infrastructure investments. Expert interviews and business surveys of key business leaders and local or state planning authorities can be used to evaluate the area's transportation needs, constraints, and threats to economic growth, and how the proposed transportation investment might improve each of these. The use of comparable case studies is sometimes used which document the before-and-after experiences of other regions that have completed similar types of transportation investments. This type of assessment is useful when presenting to the public, as it is easier to understand than the more rigorous economic quantitative models [76].

Productivity Models

Many studies have tried to develop a model demonstrating a statistical link between the level of public infrastructure stock and productivity growth. Very few of these studies have tried to examine the effect of transportation capital only, with most studies examining aggregate infrastructure including utilities and communication. The most common model used is the production model shown below (in Cobb-Douglas structure):

$$Y_t = (MFP)_t * L_t^\alpha * K_{P,t}^\beta * K_{G,t}^\gamma \quad (3-2)$$

where Y = aggregate regional output (e.g. gross regional product)

MFP = measure of multi-factor productivity

L = aggregate hours worked by labor

K_P = private capital spending

K_G = non-military capital spending

t = denotes time

Given the estimated parameters above, the major objective of most studies has been to compute the elasticity of output with respect to the public infrastructure stock, or ϵ_G , where:

$$\epsilon_G = \left(\frac{dY}{dK_G} \right) \left(\frac{Y}{K_G} \right) \quad (3-2)$$

The major limitation of this model is that it assumes that the effect of public and private capital on output occur simultaneously and independent to other variables such as the size of the labor force or factor productivity. To address these limitations, other studies have adopted a cost function model approach. The object of this model, like the production function model, is to

investigate the effect of capital infrastructure on economic growth and productivity. The major assumption of the model is that the cost function represents the behavior of industry with respect to the demand and use of inputs, which is manifested in private industry's cost minimization behavior. The general structure of the cost function model is shown below:

$$C = C(w, K_P, K_G, t, Y) \quad (3-4)$$

where: C is the Private Sector's cost function

w is a vector of input prices

K_P is Private Capital

K_G is Public Capital

t is a time index (representing technological change)

Y is output

The key element of the studies' analyses is to determine the impact of public capital on productivity by computing the cost elasticity: $-\delta \ln C / \delta K_G$.

The number of studies using production and cost models that focus strictly on transportation infrastructure investments is very limited. Banister and Berechman (2000) examined seven studies of primarily highway capital investments across the 48 contiguous states and found that output elasticity with respect to transportation capital investment ranged from 0.08 to 0.384 [77]. This means that a 1% increase in capital expenditures corresponded to a 0.08% to 0.384% increase in GRP (gross regional product). The table below compares the findings to international studies on capital investments done during the same period:

Country	Scale	Output Elasticity of Public Capital*
U.S. (7 Studies)	State	0.08 – 0.384
Korea	Country	0.19
Taiwan	Country	0.18
Mexico	Country	0.05
Spain	Country	0.24
Germany	Country	0.05
Japan	Regional	0.20
France	Regional	0.08
OECD	Multi-national	0.07
Developing Countries	Multi-national	0.07

* Highway capital was isolated in U.S. studies, but aggregated in other countries with all public capital investments

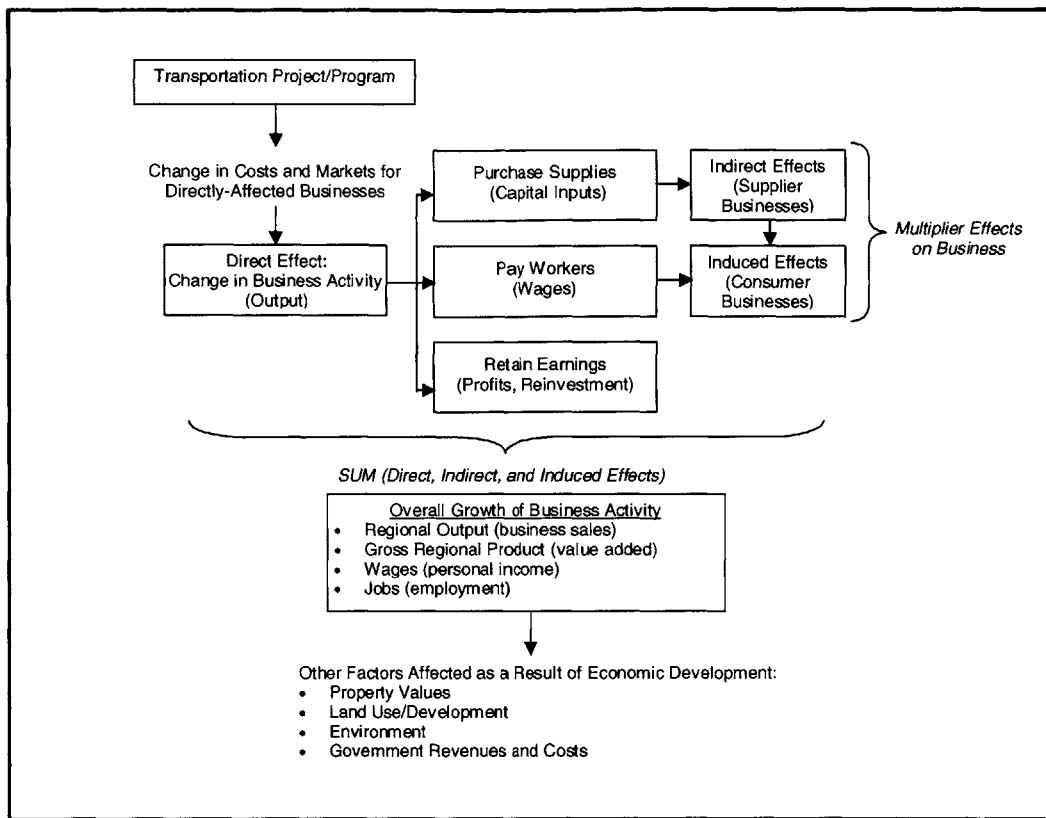
Source: Banister and Berechman, 2000

Table 3-4: Productivity Impact of Transport Investment

The problems with production and cost models are threefold. First, the models assume that the available level of transportation infrastructure is efficient and that better management, improved maintenance, or operations using ITS could not increase the level of services, and assumes that only additional investment will impact further growth. This assumption could lead to a faulty policy guide, as better management of available infrastructure may yield the same economic growth effects as new investment. Second, and more importantly, the models assume that increases in transportation infrastructure lead to greater economic output, implying a one-way direction of causality. There is no reason not to assume the opposite; where rising productivity and output in a region leads to increased infrastructure investment. The final problem of production and cost models is the lack of a spatial component. Because transportation services are provided within a network, what happens in one place affects what happens in another. These models do not incorporate spatial connections or encompass network-wide effects.

3.5.2 Measurement Frameworks

Weisbrod (2000) presents the most common framework used in assessing and allocating benefits for transportation investments. Indirect and direct effects on business, income, and economic growth are computed. The sum of these is determined to be the total effect on economic growth. The total effect divided by the direct effects only is called the multiplier effect and used to quantify the “dynamic” or induced impacts from the investment. Finally, additional effects because of economic growth such as property values and environmental impacts are measured. The traditional transportation impact on economic development measurement framework, rooted in historical cost-benefit analysis, is shown in Figure 3-8 [78]:



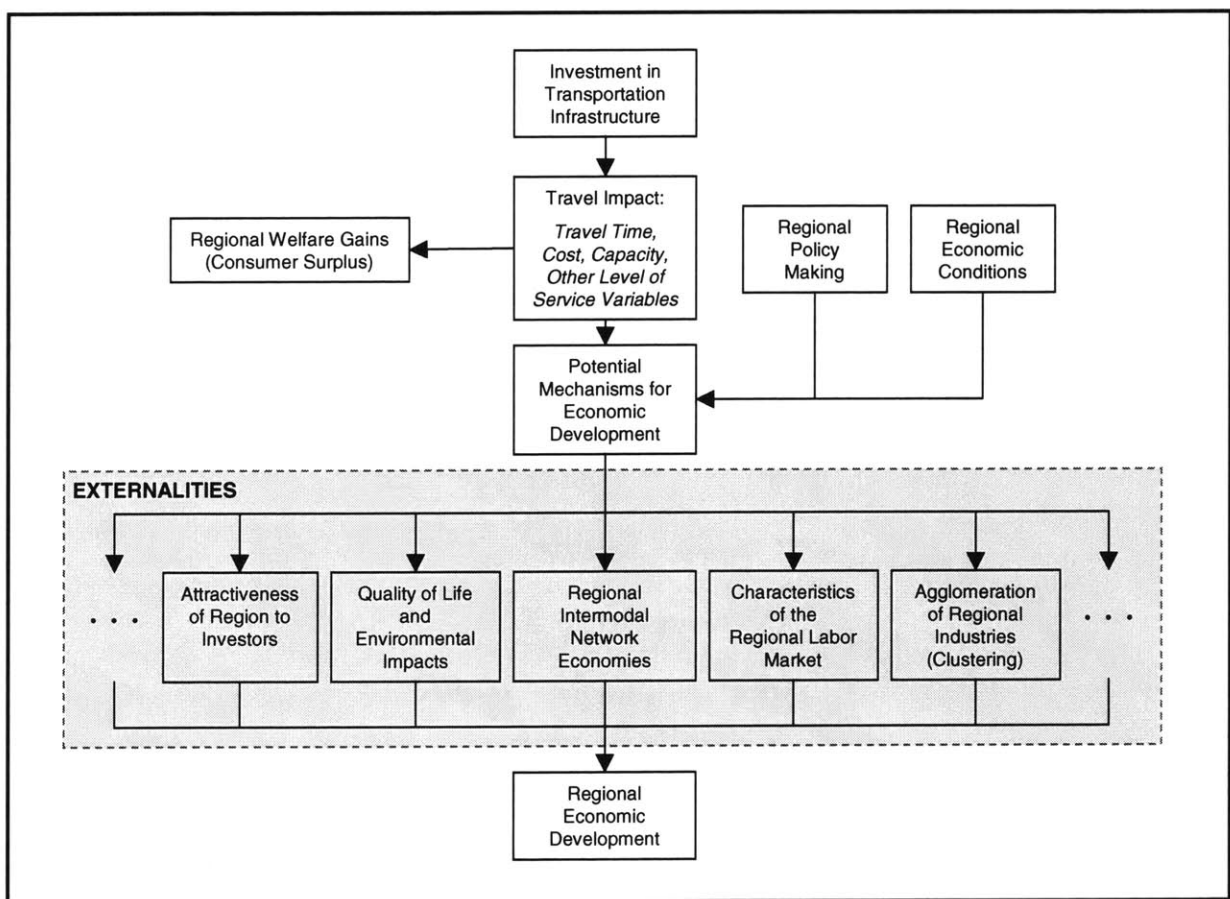
Source: Weisbrod, 2000

Figure 3-8: Traditional Framework for Evaluation of Economic Development Impact

Banister and Berechman disagree with the traditional measurement framework, arguing that the degree to which an improvement in transportation infrastructure affects economic development is not independent of the economic and demographic characteristics of a region. Similar to their arguments summarized in Section 3.3.4, the traditional framework raises important questions, such as:

1. Does the above framework correctly represent the relationship between infrastructure investment and economic development?
2. Does the framework actually double-count benefits?
3. What in the framework demonstrates the link between transport investment and economic development?
4. What are the necessary conditions for economic development to occur from a transport infrastructure investment?

Banister and Berechman argue that the transportation system should be viewed as a constraint on the ability to achieve economic development. An additional investment in transportation infrastructure and systems lessens this constraint, and further enables the opportunity for economic development. As a region's infrastructure becomes more developed, it has a less binding effect as a constraint on economic development. In general, even a large size transportation investment, in monetary and physical terms, often represents only a modest expansion of an in-place network and, consequently, may have only small mobility and economic effects [79]. To properly measure the potential economic development impacts, Banister and Berechman have proposed a new framework shown in Figure 3-9:



Adapted from: Banister and Berechman, 2000

Figure 3-9: New Framework for Linking Transportation Investment to Development

Several important differences exist between this new framework and traditional ones. First, the investment multiplier is excluded from the structure. The authors argue that the multiplier effects of an investment occur over a relatively short period, and are a static impact rather than one that continues to develop dynamically into the future. Second, “extra” benefits such as property

appreciation and other externalities, which arise when a reduction in transportation cost alter relative prices in other markets, are omitted in the new framework. This effect is not considered economic development, but instead is a symptom of development and a reflection of pricing mechanisms. Third, specific travel time and accessibility user benefits are assigned exclusively to the consumer surplus, reflecting that they may impact economic growth, but not development. Finally, and most importantly, the three necessary conditions that must be present for economic development to occur, as described in Section 3.3.4, are explicitly included in the framework.

The framework underscores Banister and Berechman's contention that economic development from infrastructure is predicated only on the presence of certain externalities in the region. If these externalities are not present in the regional economy, then all benefits from an investment are confined to travel or accessibility related benefits. Since these benefits are fully represented as welfare gains (i.e. consumer surplus), further development effects cannot be expected. It is only when the policymaker, planner, or analyst can demonstrate the existence of these externalities that additional economic growth benefits can be rightly assigned to the investment. Regional competitive advantage is implicitly incorporated into the framework through the recognition of cluster dynamics within the externalities component.

3.5.3 Measurement Challenges

The selection of the proper framework to determine and allocate the benefits of transportation investment is often only half the challenge. There is a large gap between data that is available and data required to answer questions raised by policy and decision makers. The challenges related to data requirements to measure economic development impacts from transportation are fivefold. First, a large gap in most studies is the lack of information on the flows of goods and people. Second, most analyses of the relationship between transportation investment and economic productivity do not take into account the intensity of use of transportation systems. Thirdly, another deficiency is the lack of information linking location of businesses and households to the location of transportation systems that provide the services. Most are aggregated at the state or national level, falling far short of establishing the necessary spatial link at the regional level or lower [80]. Next, as discussed in Chapter 2, economic data is most easily attained for items such as job and income growth rather than measurements of net productivity effects. The economic impacts of transportation infrastructure are extremely difficult to disaggregate from other public capital investments, especially at the regional level. Finally, the magnitude and significance of the effects are far from conclusive, even if given adequate

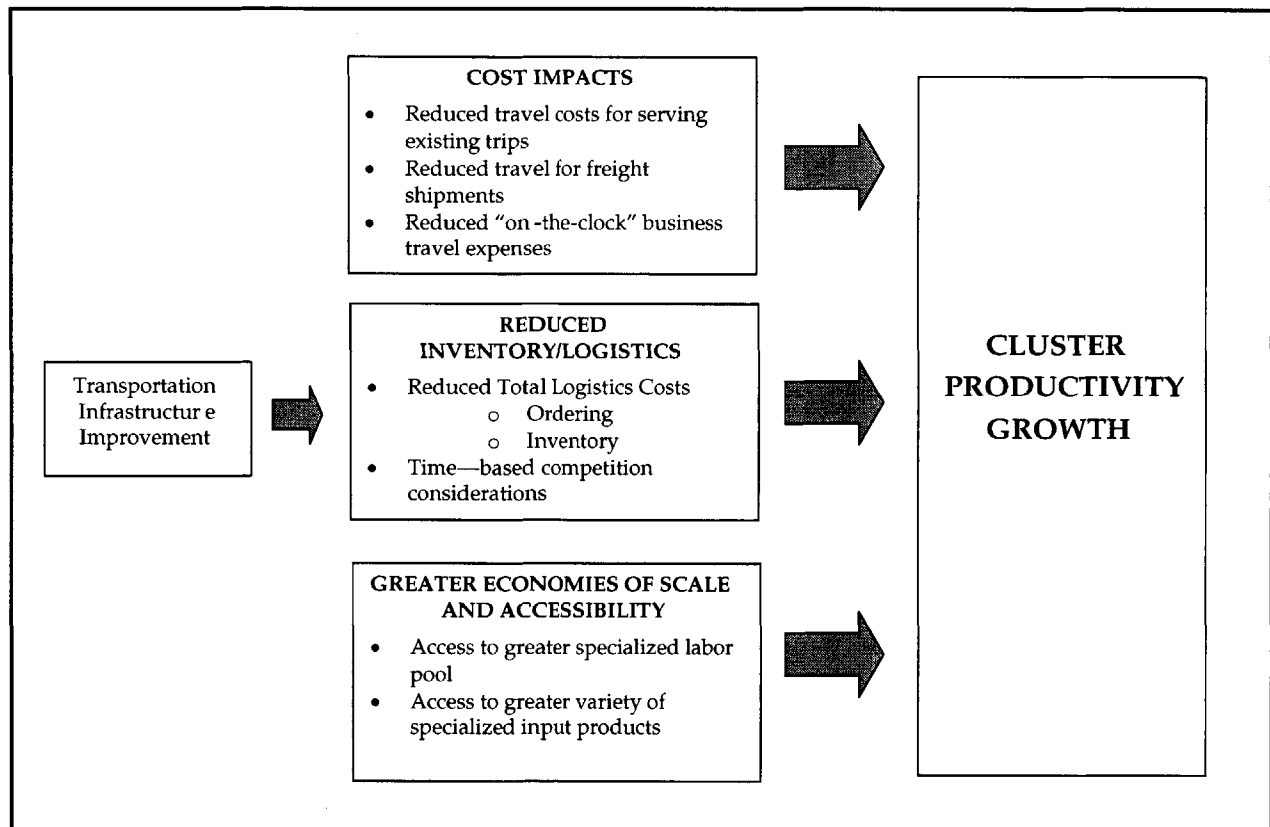
measurement data. The causality issue discussed in Section 3.3.4 is a significant problem both in terms of direction (e.g. economic development leading to infrastructure investment) and cause (e.g. political and economic climates).

3.6 Linking Transportation Investment to Clusters - Revisited

Section 2.6 provided nine examples regarding the roles transportation infrastructure might play within an cluster-based economic development. In this section, the role of transportation infrastructure within clusters and economic development is expanded. The following aspects are considered: productivity improvement, facilitation of cluster specialization, enabling face-to-face communication, and providing clusters access to specialized inputs and outputs.

Productivity Improvement

Several aspects of cluster productivity that can be affected by transportation investment as shown in Figure 3-10:



Adapted from: Weisbrod, 1998

Figure 3-10: Potential Productivity Growth from Transportation Infrastructure Improvement

There are several limitations to the notion of productivity as a measure of economic development impact and level of competitiveness. First, productivity measures do not necessarily capture social benefits or negative externalities. Second, there is only a limited base of information on how productivity effects of transportation infrastructure can differ by specific combinations of mode, industry, and region. Finally, the marginal impact of future transportation investment on economic development may have weakened compared to the past for several reasons: (1) development of a ubiquitous highway system over the past 40 years increasing the accessibility of most metropolitan areas; (2) decentralization of employment and residences to the suburb; and (3) lack of coordinated regional transportation planning [81].

Facilitation of Cluster Specialization

Cluster growth relies on increasing specialization of the regional industries and inputs. Increased specialization means that each region becomes increasingly concentrated and focused on specific services and end-products as productivity is improved. To be fully able to take advantage of these productivity gains, a larger and larger volume of goods and/or services must be exchanged with other regions. The intensification of a region's degree of specialization presupposes an extensive trade with other highly specialized regions, and an extensive trade in goods and/or services presupposes a well-functioning transportation system. As a growing share of trade between highly developed regions deals with high-value knowledge-intensive goods and services, the importance of rapid, frequent, and reliable goods and passenger transportation is increased.

Face-to-Face Communications

There exists a need for face-to-face contacts for firms in all industries, even if contacts vary in duration, extent, scope, purpose and so on between different firms and industries within a cluster. An education cluster or R&D cluster have a larger relative need for face-to-face contacts. Claims have been made that modern information technology together with telecommunications will be able to substitute for face-to-face contact, and in turn, business trips. This is probably true for the part of face-to-face meetings that have as their only purpose the transfer of routine information. However, many face-to-face meetings have purposes other than the transfer of routine information. Instead, they concern qualified knowledge transfer, the selling and buying of non-standardized and specialized products, negotiations, non-standardized decision-making, lobbying, and service production. In today's economy, it can be observed that a growing share of all employees are (1) engaged in service production; (2) employed in knowledge-creation or

knowledge-transfer jobs; and (3) receive more education, often at the university level. With these observations, it is apparent that there are dynamics working in the direction of increasing the demand for face-to-face contacts. Also, general diffusion of computers and cellular phones has made it much easier to schedule business meetings, book tickets, and rent vehicles. Improving conditions for business trips and in turn, face-to-face meetings, are a central condition for economic integration and cluster development. Face-to-face communication is considered essential for cluster development, playing important roles in several of the foundations of industry clusters that were introduced in Section 2.4.2, most importantly inter-firm cooperative competition and informal linkages between companies which facilitate innovation.

To understand the role of face-to-face communication in an industry cluster, Hanson (1995) argues that communication linkages between firms and firm employees can be categorized into three distinct types, each having different objectives and, more importantly from a transportation planning perspective, requiring different degrees of transportation infrastructure to be carried out successfully [82]. The three types of communication links are orientation tasks, planning tasks, and programming tasks. By classifying a cluster by their communication linkages, insight can be gained as to what intensity transportation infrastructure will be utilized by the firms within the cluster.

Orientation tasks involve initiating new projects that require complicated discussions, difficult negotiations, or iterative assessment of prospects. In general, these activities involve considerable non-routine decision-making and dealing with unforeseen situations. This inherent uncertainty makes face-to-face meetings particular important, allowing for immediate feedback. The complexity of these orientation tasks often requires consultation with a variety of specialists (consultants, industry experts, etc.). In turn, prearranged face-to-face meetings of varying degrees of duration and varying locations make travel an essential component of the daily work life of the managerial, professional, and technical labor forces of these cluster firms.

Planning tasks represent efforts to implement decisions that have already been made, including for example, implementing marketing or production plans. Although each problem to be solved may be unique, there are established channels of communication used in resolving, with non-routine decision-making. The communication contacts are generally less spatially dispersed than most orientation tasks. Often, indirect contacts via telephone, mail, or electronically are sufficient to carry out planning tasks.

Programmed tasks refer to routine and repetitive exchanges of information and decision-making that is based on structured and standardized procedures. Many production, sales, and clerical tasks fall into this category, requiring primarily indirect contacts.

Typically, the transition from orientation to programmed tasks within a firm requires less time and tasks that require less utilization of transportation services. Therefore, a cluster whose activities involve more orientation tasks will rely on the effectiveness of the regional transportation infrastructure more intensely than a cluster whose activities are more often characterized by programmed tasks.

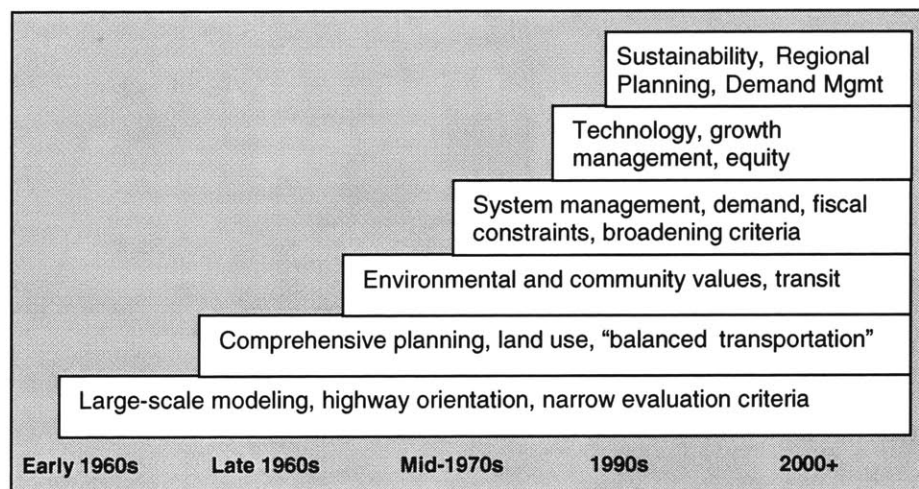
Expanding Access to Specialized Inputs and Outputs

The production of services in a regional economy is characterized by face-to-face contacts and a high business travel frequency, which in turn requires a high market threshold to support its production. The price of business trips, and in particular, the value of the time used for a business trip, limits the inter-regional exchange of services. As a result, the degree of specialization of the region's transportation infrastructure for this type of travel is one factor that limits the integration of service production within a geographical area. Investments in infrastructure that reduce travel times open new opportunities to integrate markets for producer services by an increased volume of business travel and business travel extends the wider geographical area boundaries of a cluster extending their market potential. Cluster firms can also have a broader and more qualified supply of specialized inputs such as labor force and producer services. Marginal productivity improves as inefficient producers are substituted for by more highly productive and efficient service providers as the access and geographical reach is expanded.

In conclusion, this chapter has attempted a brief look at the relationship between economic development and transportation infrastructure, introducing several frameworks with which to evaluate the impact of a transportation investment. Chapter 4 moves on to a review of the transportation planning process and introduces the ReS/SITE framework which will be used as the foundation for integrating the notion of regional competitive advantage within the transportation planning process.

Chapter 4. Regional Transportation Planning & ReS/SITE

Over the past fifty years, transportation planning has reflected shifts in issues and concerns of federal, state, and local officials. This evolving process has included (1) a broadening perspective of what is included within a transportation system (multimodal definition, regional context, and so forth); (2) new actions to address transportation problems; and (3) an expanding and refining of the measurement of transportation's benefit and cost. Meyer (1999) maps the evolution of the transportation planning process as shown in Figure 4-1. An important point reflected in the evolution is that the process continues to expand with the *addition* of new criteria and planning perspectives, rather than *replacement* of the new over the old. However, to a large extent, the basic mission of transportation planning has remained the same – providing mobility in as safe and cost-effective manner as possible. It is the scope and breadth of this mission that has changed significantly.



Adapted from: Meyer, 1999

Figure 4-1: Evolution of the Transportation Planning Perspective

Kho (1995) provides an excellent summary of the evolution of the transportation planning process and a description of the roles and responsibilities of the most important stakeholders in the current process [83]. The challenge for regional transportation planning is to overcome the mismatch between fragmented local institutions and the scale of regional problems. The establishment of a truly comprehensive regional body, with authority over major government functions, is likely an unrealistic solution to this local fragmentation. In the United States, Americans seem to be supportive of smaller government entities, with the federal government playing a strong role in the shaping and defining of metropolitan structures and planning. In the

absence of a single, multi-functional regional agency, responsibilities have historically been distributed among multiple regional entities. This chapter will examine the central role the Metropolitan Planning Organization (MPO) has often played in regional transportation and in the coordination of the multiple agencies responsible for planning. Next, the creation of a new type of planning authority, the Georgia Regional Transportation Authority, will be briefly examined both as an example of the evolving role of regional transportation planning organizations and the on-going deficiencies of integrating economic development within the process. Finally, the ReS/SITE framework for regional strategic transportation planning will be introduced and described in order to later establish a methodological approach to better integrating regional competitive advantage considerations within the transportation planning framework.

4.1 Regional Planning and the Metropolitan Planning Organization

The roots of MPOs date back to the early twentieth century in the form of councils of city governments. In the early 1960's, their ability to conduct wide-scale transportation planning studies became more substantial as computer models were developed and implemented. The Federal Highway Act of 1962 established the 3-C (Continuing, Cooperative, and Coordinated) planning process which was to be carried out by representatives of local governments in areas with a metropolitan population of over 50,000. The 3-C planning process gave regions veto power over highway projects, and increased the visibility and importance of the MPO. However, for the next three decades, the MPO typically had little control over transportation funding and planning decisions as the state legislature controlled the matching funds necessary to obtain federal approval for transportation projects. This began to change with the passing of the Clean Air Act Amendments in 1977 which gave the MPO responsibility for the planning of transportation plans in response to air quality conformity issues. Still, before the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, and TEA-21 in 1998, the MPO remained a relatively weak institution which was commonly dominated by state DOTs.

ISTEA assigned the MPO new decision-making responsibilities, along with increased flexibility to develop transportation plans that met their region's particular needs. The Act gave the MPO decision-making authority that had previously rested with the state DOTs or highway departments, but required that the MPO coordinate with the state DOT on interregional projects. ISTEA was a response to the need to devolve transportation planning and project selection to the regional and local levels. At this scale, the framers of ISTEA felt the complex social, economic,

and environmental issues would be better accounted for, and the MPO would serve as a forum for discussion, as well as to provide information and analyses needed for an informed debate. In 1998, Congress passed the successor to ISTEA, TEA-21, which streamlined the MPO planning requirements, but kept the basic decision-making authority for the MPO. The explicit justification for this continued policy was the recognition of the growing importance of regions as competitive units in the world economy [84]. With ISTEA and TEA-21, one of the biggest challenges for the MPO is the requirement to find specific funding sources for all projects in its short-term and long-term transportation plans. This requirement has been turned into an opportunity by some MPOs as it allowed them to take new leadership roles in the region, and allowed them to become advocates for the region at the state level. Additionally, the fiscal constraint was a strong motivation for many MPOs' decisions to partner with state, local, and private organizations.

Although neither ISTEA nor TEA-21 explicitly use the word “partnership,” the term has become widespread in describing the relationship between the MPO and public or private organizations. As introduced in Chapter 2, partnerships are also a very important component of cluster-based economic development. The need for partnerships is due primarily to two reasons: (1) although an MPO has decision-making authority over the funding of transportation investments, they do not have any authority for land use decisions; and (2) their role in economic development is often an indirect one, resulting from the impact of their infrastructure and transportation service investment decisions, rather than from a coordinated effort with economic development organizations.

Goldman and Deakin (2000) describe the process by which regional agencies, including MPOs, have tended to gain responsibility and authority through an incremental process of establishing legitimacy [85]. The process, as described below, bears striking similarity to Gollub's Cluster Policy Framework process described in Section 2.5.3.

Step 1: A coalition of citizen organizations, business groups, and regional councils of governments defines a broad policy of regional concerns and invites stakeholders to participate in strategies to address them.

Step 2: The coalition assesses the region's technical, civic, and political capacities for implementing the policy and adopts action plans for meeting shortfalls in the capacities.

Step 3: The coalition next works to implement its action plan by strengthening existing institutions, or creating new ones if necessary. Often, policy mechanisms are implemented that link the region more closely together.

Step 4: A regional agency is created or designated to create a transparent and participative structure within a system to monitor and measure policy actions over time.

The outline policy relies heavily on the partnership concept. However, although there are well-documented partnerships with state DOTs, land-use agencies, and transportation organizations, there is little evidence of partnerships between MPOs and economic development groups and private organizations. Most MPOs have focused their efforts on passenger transportation issues and investments, with only relatively recent recognition of the need to study regional goods movements in addition to the flow of people. Historically, large-scale freight projects appear unattractive to MPOs as they prove politically difficult due to an often concentrated negative impact at the local level, even while providing large regional benefits. Furthermore, MPOs are often hesitant to support public financing for projects perceived to largely benefit particular private companies. The preceding points illustrate the difficulties that MPOs could face should they be given a larger role in the economic development process required by cluster initiatives.

4.2 The Role of the MPO in Economic Development: The State of the Practice

Because of ISTEA and TEA-21, most metropolitan areas in the United States now engage in some form of regional planning through its MPOs, but Levine (1999) claims that it may be fairly said that many of these metropolitan areas engage in transportation planning as the *only* form of regional planning [86]. Because of their transportation focus, ISTEA and TEA-21 represent only a baseline, or lowest common denominator among regional planning efforts, especially economic development. Of course, economics is not the only factor that the MPO must take into account in its regional transportation decision-making process. Issues of equity, wealth redistribution, regional image, or metropolitan solidarity can be as important as economics when planning at the regional level. While coordinated regional planning focuses on network systems such as transportation infrastructure and utilities, they represent only two of many inputs required to generate economic development.

Given their often *de facto* status for a region's planning efforts, Levine (1999) conducted a comprehensive survey of 248 MPOs around the United States to determine their level of involvement in economic development. His findings are summarized below [87]:

- The survey found that only one-third of the MPOs had any specific responsibilities for economic development planning. The most commonly cited issues for which the MPOs surveyed had specific responsibilities for are listed in Table 4-1:

Responsibility	MPOs Citing Responsibility For
Transportation	98%
Air Quality	50%
Land Use	47%
Growth Management	40%
<i>Economic Development</i>	33%
Water Quality	30%
Airport Planning/Management	22%
Workforce Development	16%

Source: Levine, 1999

Table 4-1: MPO Regional Responsibilities

- Despite the increased attention on changes in economic development practice and involvement of new stakeholders, Levine found that local political jurisdictions still fill the primary role in most economic development decision-making. However, a surprising number of MPOs reported being involved in the economic development policy-making process, nearly the same as Chambers of Commerce. The research did not allow for an assessment of the degree involvement. In Table 4-2, the results are tabulated for the question posed to the 284 MPOs: "Which of the following groups share in developing and implementing economic development policies for your metropolitan area?"

Group	Regions where Group Shared in Econ. Development Responsibilities
City Government	93%
County Government	85%
Chambers of Commerce	68%
MPO	64%
State office of economic development	63%
Non-profit development corporations	47%
Metropolitan economic development agency	41%
Metropolitan public-private partnerships	25%

Source: Levine, 1999

Table 4-2: Groups Sharing in Economic Development Planning

- The coordination efforts for regional economic planning was characterized as fragmented (Table 4-3) and poor (Table 4-4) as shown the results below:

Group	% of Groups Taking Regional Coordination Leadership Role
Private Sector	20%
MPO	15%
No one	10%
Non-Profit Group	6%
Other Public Agency	40%
Other Organization	9%

Source: Levine, 1999

Table 4-3: Fragmented Leadership Roles in Coordinating Economic Development

Degree of Coordination of Regional Economic Development Efforts	% Responding
Most Efforts Routinely Coordinated	5%
Some Efforts Coordinated, Others Not	45%
Ad-hoc Coordination	25%
No Coordination	25%

Source: Levine, 1999

Table 4-4: Poor Degree of Regional Economic Development Coordination

- When asked to list the four most important economic regional assets that stimulate or enhance economic performance, the MPOs' most cited answer was transportation infrastructure and investment, an unsurprising result given the MPOs' roots in transportation planning. However, the result is of some concern, given the discussion in Section 3.3.2 that highlighted the notion that transportation investment is actually playing a declining role in economic development in the developed world.
- When assessing economic development, the most common forms of measurement by MPOs were: (1) change over time in per-capita median income – as a basic measure of local well-being; and (2) change over time in regional share of national income – as a measure of the overall competitiveness of a metropolitan region. Based on earlier discussions regarding the proper indicators of economic development, these two measures do not capture the dynamic externalities required for the ability to create and sustain competitive advantage as they simply measure only economic growth.

In summary, although only one-third of MPOs have a specific responsibility for economic development, over two-thirds reported sharing in economic development planning, indicating that the while MPOs are not playing a leadership role, they are involved in many of the efforts. The relative importance placed on transportation infrastructure for economic development, along with measures relating to growth rather than development, demonstrate that MPOs have not yet embraced the fact that transportation plays a more secondary role of providing specialized infrastructure and services in support of other, more important competitive forces in the region. Having introduced the MPO, the next section briefly presents an example of a regional transportation planning organization that has expanded beyond traditional regional transportation planning roles.

4.3 Beyond the MPO – The Georgia Regional Transportation Authority

The experience of Atlanta in the late nineties provides a good example of the evolving role of regional transportation planning organizations and the process described in the previous section by which a regional organization gains authority and legitimacy.

4.3.1 An Introduction to Georgia Regional Transportation Authority

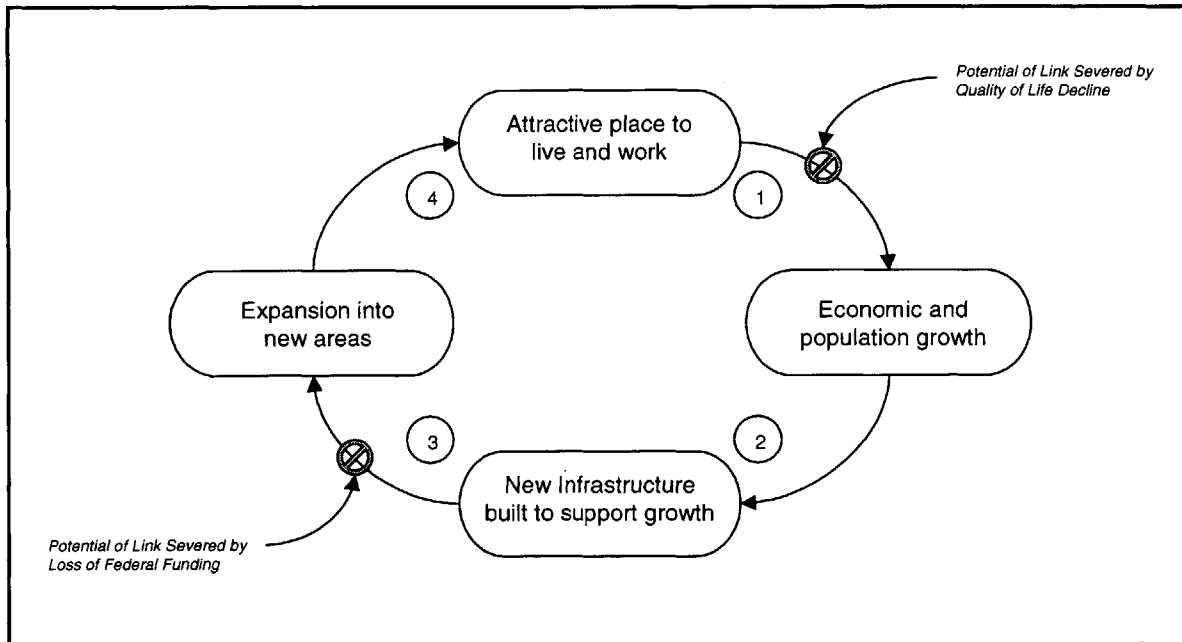
In 1998, the Atlanta Chamber of Commerce organized a group of business leaders, political officials, and academics to study the region's degrading air quality and transportation problems. The assembling of these stakeholders was primarily motivated by the (1) the EPA's threat to withhold almost \$0.5 billion in federal transportation funding because of air quality non-attainment; and (2) concern that the region's continued economic vitality rested on finding solutions to these problems. The assembled stakeholders created a commission to explore the root causes of the region's transportation problems. One of the main conclusions of the commission was that the region's MPO, the Atlanta Regional Commission (ARC) did not have the proper authority to address the situation. The commission recommended the restructuring of the regional planning process with increased authority to coordinate transportation planning, the outcome being the creation of the Georgia Regional Transportation Authority (GRTA), a governor-appointed body of 15 regional leaders.

4.3.2 Motivating Needs for Restructuring the Planning Process

From 1960 to 1990, the population of Atlanta grew 142%, mostly in low-density areas outside of the central business district (CBD). Population growth occurred in parallel to the dispersal of employment centers beyond the CBD. To accommodate this growth, an auto-dominated transportation network was built, reflected in the fact that Atlanta now leads the nation in vehicle miles per capita traveled. Even with a large investment in road construction and expansion, the regional congestion grew, estimated at over \$1.5 billion annually in fuel expense and lost time in 1999. Air quality also grew increasingly worse, with the city classified as a non-attainment area relative to the Clean Air Act standards. Sixty-eight percent of all NO_x emissions are from mobile sources, meaning that the dependence on the automobile was an important factor in the air quality problem [88].

Air and transportation problems attracted negative regional and media attention that questioned the perception of a high quality of life in Atlanta. National real estate firms downgraded Atlanta's growth prospects in 1997. This combination of congestion, potential withdrawal of federal funding, and the real estate industry's potential reluctance to invest in Atlanta forced the region's businesses, as represented by the Greater Atlanta Chamber of Commerce, to take action [89].

The commission formed by the Chamber of Commerce concluded that the crisis was threatening to eliminate two of the four basic components of the development strategy that Atlanta's economic development organizations had been following – expanding road infrastructure and perceived high quality of life. The commission represented Atlanta's economic development cycle as a “virtuous cycle” and identified the threats to its continued perpetration as shown in Figure 4-2:

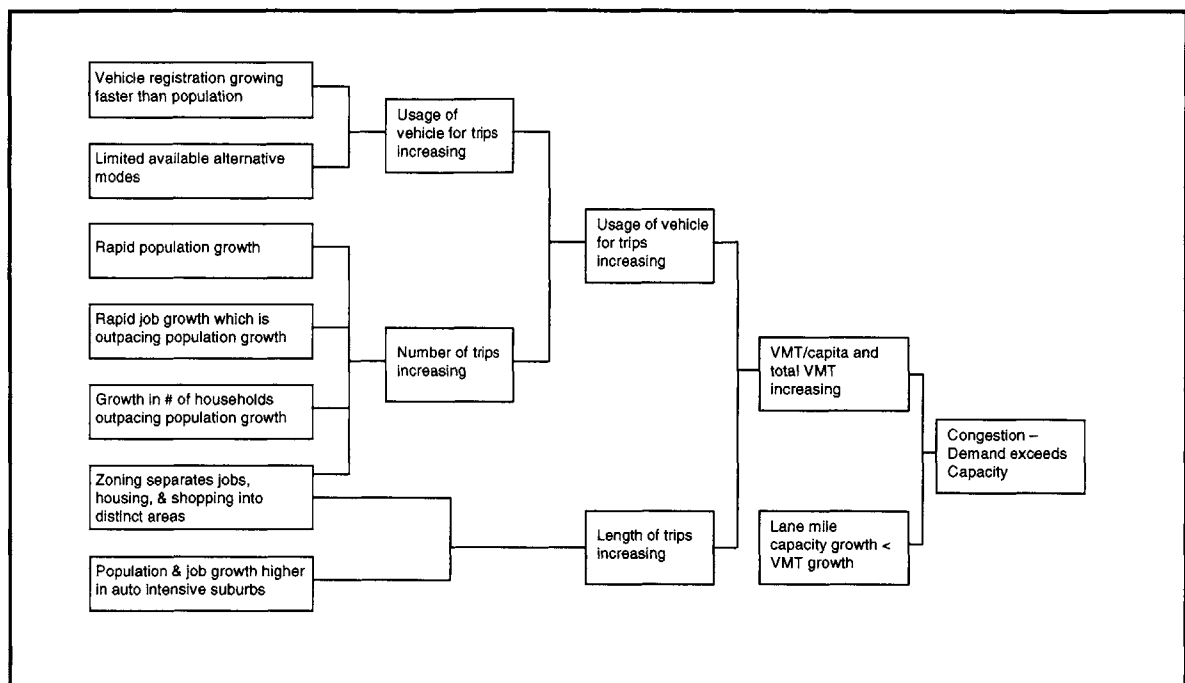


Adapted from: Trelstad, 2000

Figure 4-2: Atlanta's “Virtuous Cycle” of Economic Development

Losing federal funding and decreasing quality of life both threatened to sever the links the commission felt were binding together the “virtuous cycle” of Atlanta economic development. Based on the assessment of the cycle of economic development, the commission defined the ultimate goal of their reevaluation of the regional planning process was “to develop an effective, balanced transportation system that would help Atlanta sustain economic growth and a good quality of life [90].”

Because of the threat posed by congestion to the cycle of economic development, the stakeholder commission mapped out the factors, shown in Figure 4-3 which were leading to the increasing problem.



Source: Trelstad, 2000

Figure 4-3: Factors Leading to Increasing Congestions

As a result of the analysis of the factors leading to congestion, the commission determined that technological solutions and an expansion in the road network would be inadequate responses. Instead, they turned their attention to the regional transportation planning process. The commission discovered that the current process involved ten separate regional county DOTs which sent their plans to the central MPO, which simply aggregated all ten plans into a “regional plan,” with no objective criteria used to evaluate the collective impact of the transportation investments on congestion [91].

4.3.3 The Creation of GRTA

The final outcome of the commission’s investigation of the regional issues was the creation of the GRTA in 1999. The regional organization was designed to have broad planning powers with land-use authorities in order to address the set of interconnected problems. The new organization was given three main authorities: (1) control over federal and state transportation funding which have regional impacts; (2) the ability to set minimum planning standards for metropolitan

counties that, if not met, can cause state grants to be withheld; and (3) the ability to approve and implement regional transit facilities.

It is important to emphasize that these authorities represent an approach which is nothing short of radical for regional planning in the U.S. context. While it is too early to assess the overall impact of the GRTA, four lessons can be drawn from the process that led to its creation [92]:

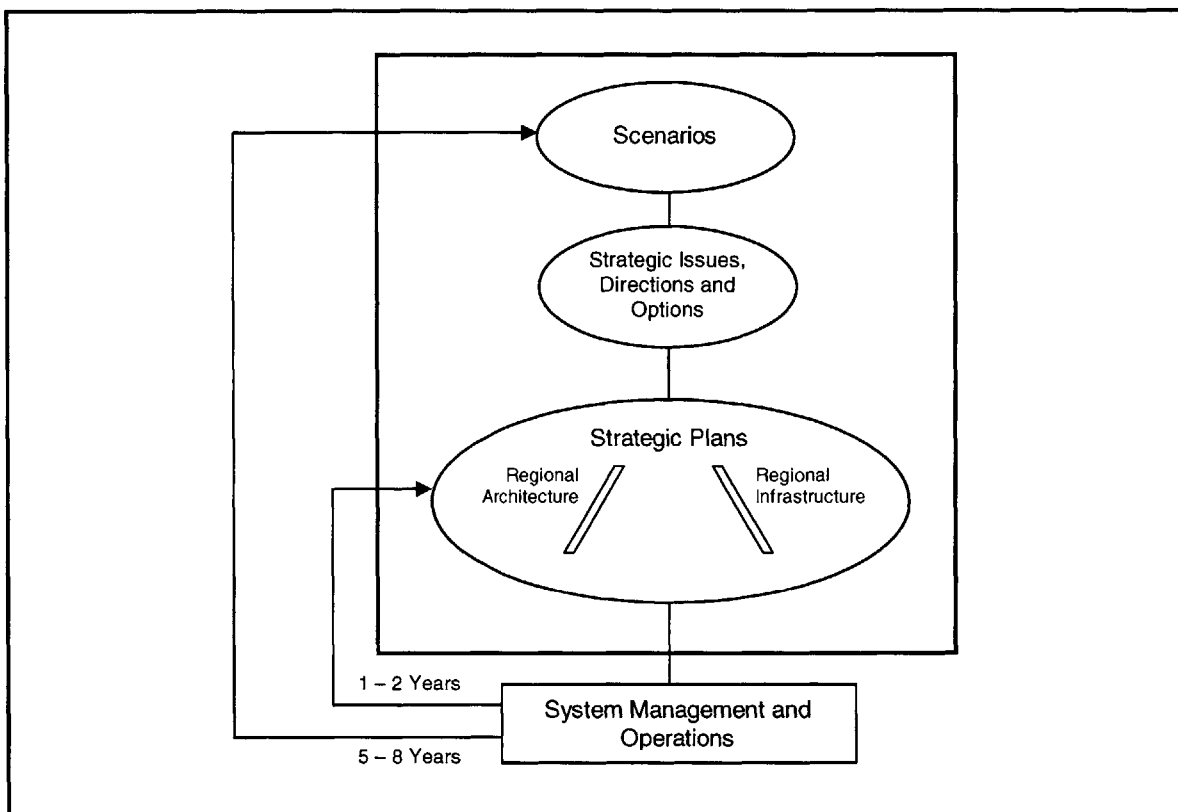
1. Crisis plays an important role in creating the stimulus for political action. This is similar to what was discussed in Section 2.5 for the stimulus to develop and implement a cluster initiative.
2. Private and academic partnerships are important and add a level of objectivity to the process.
3. Rather than trying to create the perfect planning agency, regions need to consider simply improving the alignment between existing state, regional, and local organizations. The GRTA helps create this alignment through its broad authority and its ability to connect federal and state policy with local plans
4. The simple system reflected in Atlanta's "virtuous cycle" demonstrates that the complexities of economic development are still not fully appreciated, even in very progressive regional planning efforts. The important role played by Atlanta's leading industry clusters was overlooked, effectively ignoring the significant driver of the region's competitive advantage.

4.4 A Framework for Regional Transportation Planning

4.4.1 The ReS/SITE Framework

The ReS/SITE (Regional Strategies for the Sustainable Intermodal Transportation Enterprise) was developed in the mid-nineties by a MIT research group as a framework for analyzing the transportation issues in the Province of Mendoza, Argentina. The Province was evaluating a proposal to create an intermodal link to Santiago, Chile and on to the Port of Valparaiso, by way of a railroad tunnel through the Andes Mountains, thereby providing Argentina access to the Pacific Rim. The ReS/SITE framework grew out of the recognition that the tunnel could not be evaluated without consideration of the broader regional transportation strategy. In developing the

framework, a review of strategic transportation plans from around the world was undertaken. Based on the review, shortcomings in the current regional strategic planning process were identified. The shortcomings were classified into eight categories, including the relevant category for this thesis: the need to more adequately address economic development and the importance of assessing the significance of transportation investment to develop and sustain a regional competitive advantage. A more complete description of the identified shortcomings and how the ReS/SITE framework addresses them can be found in the Appendix, along with references for the theoretical development and application of the framework. The basic ReS/SITE framework is shown below in Figure 4-4:



Source: Sussman and Conklin, 2001

Figure 4-4: Basic ReS/SITE Framework

Conklin and Sussman summarize the components of the framework as described below [93]:

Scenarios

Scenarios grew out of the concept from industry in which business plans are developed to effectively address a large array of potential future outcomes. In this context, scenarios are a range of structured views of the future. The ReS/SITE research found that many transportation

plans project a future condition that does not consider the many factors affecting the future possibilities. Scenarios can be used in the transportation planning process to consider different versions of the future. Trends and possible future events are structured into scenarios within a sequence of cause and effect events that reflect the central concerns and issues for the transportation planning organization.

Strategic Issues, Directions, and Options

The next step in the framework involves the development of strategies that are robust across the future possibilities identified in the scenarios. Strategy selection, rather than specific project selection, is the main consideration of this phase where needs and an assortment of solutions are considered. Goal-setting for the region occurs at this stage, including those involving desired competitiveness relative to the global economic environment.

Strategic Plans

Strategic plans are based on the outcomes of the previous steps. The strategic plan is composed of two components, regional infrastructure and regional architecture. The ReS/SITE team found that most transportation plans sufficiently address regional infrastructure needs, which has been the traditional focus of the regional planning process. The framework significantly expands the output of strategic planning to include the design of a regional architecture.

Regional architecture provides a methodology to design organizational exchanges between the public and private organizations involved in providing the regional transportation services. Regional architecture is comprised of the following components:

1. A “map” of the institutions providing the different transportation functions and how information is shared between them.
2. The definition of how control and information is distributed between the regional architecture institutions
3. A guide for the institutions regarding which organizations characterizations will best accommodate the responsibility and exchange of information

The concept of “regional architecture” was borrowed from ITS terminology, in which it is a largely technical framework concerned with communication, information flows, and interconnections. In this use, regional architecture is expanded to include the institutional point of view and organizational and inter-organizational design.

Based on an evaluation of the transportation and environmental concerns of Mexico City, Makler (2000) expanded the regional architecture component into Regional Planning Architectures (RPA) and Regional Service Architectures (RSA). RPA comprises the organizational structures promoting and developing the planning agenda for a region, while RSA comprise the set of organizations responsible for operating the transportation systems, which may be similar, but not identical to the RPA. This issue will be explored further in Section 4.4.2.

System Management and Operation

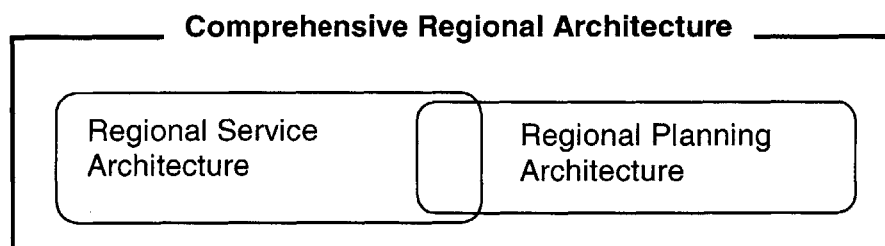
System management and operations is the short-term analogy of the strategic planning process. These actions work to ensure that the current transportation system is effectively working toward meeting the short- and long-range regional transportation and economic development goals. The management and operation plan should have the same goals as the strategic transportation plan, but will be focused on immediate 1-2 year items.

Although the framework as been applied only in academia to date, it is built on two important foundations that make it applicable in practice:

1. Metropolitan regions are progressively being recognized as the basic geographic element for economic competition
2. Introduction of new technologies, such as ITS, facilitates the ability to operate and manage transportation systems at the regional scale [94].

4.4.2 Regional Planning Architecture and the MPO

Makler expands the Regional Architecture of the ReS/SITE framework into two components, grouping them under a “Comprehensive Regional Architecture,” or CRA, umbrella as shown in Figure 4-5.



Source: Makler, 2000

Figure 4-5: Components of Regional Architecture

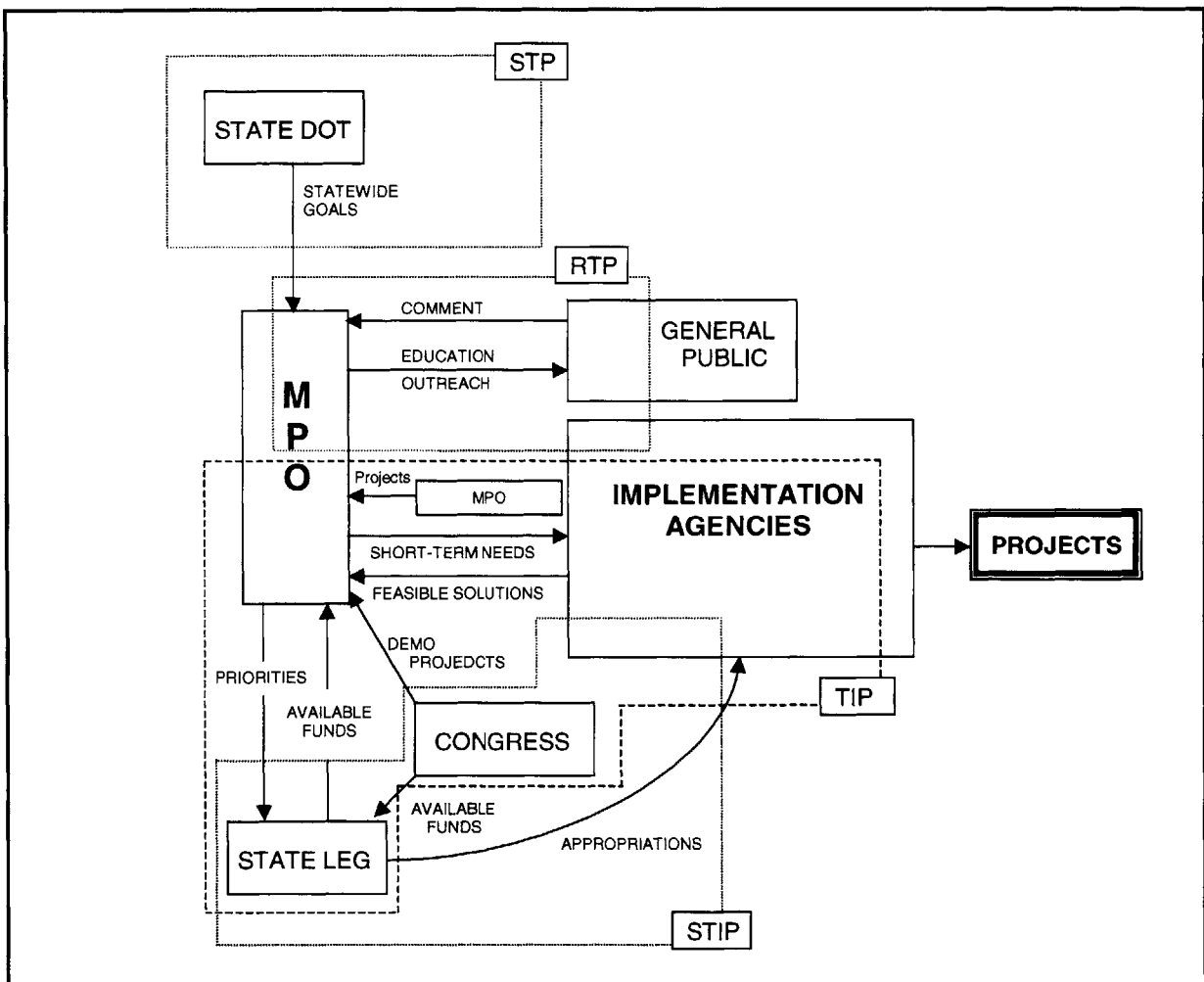
The most important characteristic of CRA is the relationship between RSA and RPA, and the fact that there could be substantial overlap between them. Makler gives the following example: A state DOT is often both an active participant in planning activities and a manager of transportation services, thus contributing a role in both RSA and RPA. Further, it is possible that one division within the DOT participates in the RSA, while another participates in the RPA. But, it is incorrect to simply assume that because an organization has internal units involved in both the RSA and the RPA, that the parent organization provides a reliable link between the RPA and RSA [95]. Within this expanded framework, Makler argues that it is possible to develop a substantial descriptive analysis of transportation decision-making within a region.

Makler provides a detailed review of the transportation planning process since ISTEA [96], and constructs the CRA for the regional transportation planning process. As discussed earlier, ISTEA established a key role in the planning process for the MPO. But, because they vary substantially from metropolitan area to metropolitan area, there are few generalizable roles for the MPO that hold across all regions. In general, they provide area-wide planning services, research, and coordination between different levels of government. ISTEA mandated four sets of transportation plans over the short and long-term horizon. For the purposes of this paper, the two most relevant are the plans mandated at the metropolitan or regional level: (1) the long-term Regional Transportation Plan (RTP) and (2) the short-term Transportation Improvement Plan (TIP). The remaining two plans are at the state level and are made up of the long-term Statewide Transportation Plan (STP) and the short-term State Transportation Improvement Program (STIP).

The TIP is prepared by the MPO at least every 2 years, and has a scope of three years or more. Any transportation project included in the TIP must be regionally significant and consistent with the long-term RTP. Any project needing federal funding is required to be included, while the inclusion of non-federally funded projects is often included for informational purposes. The introduction of the TIP provided fiscal constraint on proposed projects, rather than the previously published “wish lists” which often did not include identification of sources for funding [97]. Importantly, the Federal Highway Administration (FHWA) and Federal Transit Agency (FTA) do not participate in the approval or disapproval of the TIP, although they are involved in the funding requests. Instead, for a project to be included in a TIP, it must receive local approval first, then be brought to the MPO by a member of the local TIP council.

The RTP acts as a guidance document for the TIP, which shares the same metropolitan, or regional, scope. The RTP horizon is at least 20 years, and is revised every 3 to 5 years depending on the air quality attainment status within the region. The plan provides the overarching roadmap for transportation planning over the subsequent two decades, from which the TIP draws from or adds projects. Extensive public participation characterizes the RTP process.

Makler summarizes the Regional Planning Architecture for the transportation planning process as presented in Figure 4-6. The RPA is based on plans established in ISTEA, reaffirmed in TEA-21, and includes the institutional relationships formed around these activities and the flow of information, data, and resources between the RPA entities.



Source: Makler, 2000

Figure 4-6: ISTEA-Based Regional Planning Architecture

Makler has attempted to de-emphasize the individual plan components, and instead focuses on the institutions and connections between them. Makler identifies the most important feature of the RPA illustration of institutional relationships to be the central role played by the MPO. In this representation, the involvement of implementing agencies and other entities appear to “revolve” around the MPO. The structure also reflects the fundamental roles of goal formulation and needs assessment.

This chapter has described MPOs and the role in which they contribute to regional transportation planning. Through Levine’s research, it was demonstrated that although these institutions often play a role in economic development planning, it is usually not within a leadership role. Research on the shortcomings of current regional strategic transportation planning was summarized, and the ReS/SITE framework was presented as a means to address many of these shortcomings. The Regional Architecture component of ReS/SITE was covered in some detail, and offers a point of potential integration between the strategic transportation planning framework and economic development processes. With the conclusion of this chapter, we have accomplished three objectives of this thesis: the introduction of regional competitive advantage and industry clusters in Chapter 2, the link between economic development and transportation planning in Chapter 3, and the presentation of a framework for regional strategic transportation planning in Chapter 4. This foundation permits the investigation of regions which have undertaken cluster studies, and the evaluation of the degree of integration between these studies and the regional transportation plans. This investigation is presented in the following chapter.

Chapter 5. Regional Case Studies

Having introduced the concepts of regional competitive advantage, industry clusters, economic development, and regional strategic transportation planning; this chapter next examines case studies concerning the application of these concepts at the metropolitan and state-wide level. The following cases, summarized below, will be examined by looking at both the region-specific cluster studies and relevant transportation plans:

The Bay Area – Silicon Valley: Silicon Valley is perhaps the best example of a mature, “working” cluster. The region’s MPO is unique as it has authority over discretionary highway spending as well as multiple linkages to regional economic development organizations.

The Twin Cities – The regional MPO, responsible for developing the transportation plans, also performed one of the earliest metropolitan-wide cluster studies in the United States. However, regional economic development organizations virtually ignore transportation infrastructure in their policy initiatives. The cluster policies are very “hands-off,” versus the Bay Area’s approach of broad lobbying efforts.

Tucson – The region is undertaking a nationally-recognized effort to implement a systematic cluster initiative at the regional level. Regional economic development organizations clearly identify several transportation investment needs critical to the growth of the emerging regional clusters, although the RTP incorporates only one of the initiatives. Promotion of clusters differs from the Bay Area as there is a conscious effort to develop cluster-supporting institutional networks, versus the informal, byproduct nature of cluster support-networks in the San Francisco area.

Florida – The Transportation Cornerstone Project in 1999 represented one of the most structured attempts at assessing transportation needs on a cluster by cluster basis. The project also specifically looked at the institutional barriers which prevent cluster-specific transportation needs from being met.

5.1 The Bay Area – Silicon Valley, California

5.1.1 Regional Economic Development and Clusters

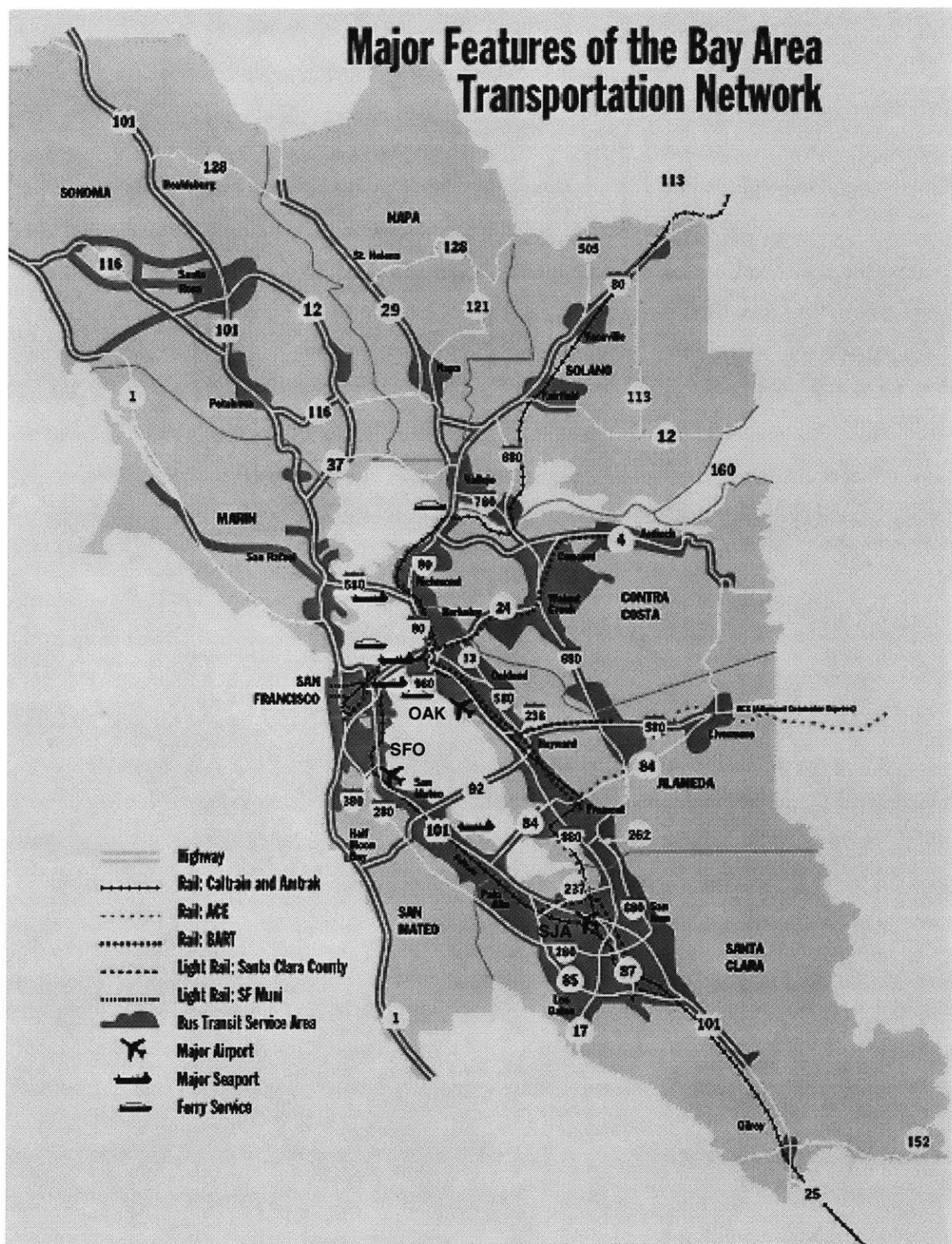
Geographic and Economic Profile of the Bay Area

The Bay Area economic region consists of the nine counties that border the San Francisco Bay: Napa, Sonoma, Marin, and Solano counties in the North Bay; Contra Costa and Alameda counties in the East Bay; San Francisco and San Mateo counties in the West Bay; and Santa Clara county in the South Bay area (See Figure 5-1). The Bay Area has a total population of over 6.7 million people and a vibrant economy, which if an independent country would be the twenty-first largest economy in the world [98]. The region is a global productivity leader in knowledge-intensive business clusters of telecommunications, computers and electronics, bioscience, multimedia, and environmental technology. The region also ranks first in productivity in more traditional areas of the economy such as retail and wholesale trade, and business services. It is second in banking and finance, behind New York and ahead of Boston. The per capita income of \$38,300 puts the region ahead of New York City and contributes to a high quality of life for the region's residents.

Historical Development of the Bay Area Clusters

The history of the recent economic development of the Bay Area, and the Silicon Valley technology cluster specifically, has been documented by Annalee Saxenian and summarized as follows [99]. The origins of Silicon Valley are often traced back to the founding of Hewlett-Packard Company (HP) in 1937 by two Stanford University graduate students starting an electronics instrumentation business. HP and a number of other small prewar technology firms emerged, each supported by Stanford. The initial scale of electronics production was dwarfed by the firms in the Boston area. World War II attracted large numbers of workers to the Bay Area for employment in war-related industries, although large East Coast companies such as General Electric and Westinghouse dominated the military contracts which were awarded.

After the war, extensive efforts were made by Fredrick Terman, Dean of Engineering at Stanford, in building ties between the university and local industry. Faculty and students were encouraged to become acquainted with the region's business. In the 1950's, Stanford introduced three institutional innovations: (1) the founding of the Stanford Research Institute (SRI) to conduct defense-related research, (2) a program to encourage regional engineers to participate in evening graduate courses at the university, and (3) the development of the Stanford Industrial Park. The cluster of industrial activity grew rapidly in the 1950s, fueled by military spending, and the area's



Source: Metropolitan Transportation Commission, November 2000

Figure 5-1: Bay Area Economic Region and Transportation Network

growing concentration of skill and knowledge. By the late 1960s, the area was recognized as a center of aerospace and electronics activity, although still small relative to its East Coast counterparts. The Santa Clara county area was given the moniker of Silicon Valley in the early 1970s because of the main ingredient in semiconductors, a fast growing industry at that time. The semiconductor industry initially began in 1955 with the Shockley Transistor Corporation, and its offshoot, the Fairchild Semiconductor Company. By 1970, the semiconductor industry was the largest sector in the regional economy. Multiple spin-offs by the founders of these first two semiconductor companies over the following fifteen years included Intel as well as prominent venture capital firms. In the sixties, the semiconductor companies were forced to produce their own manufacturing equipment, due to the early stage of the industry. This eventually led to an emerging infrastructure of suppliers, providing an important competitive advantage to start-ups in the region. By the mid-1970s, Silicon Valley employed over 100,000 technology workers, and its concentration of firms, consultants, suppliers, and venture capitalists was equal to its counterpart in Massachusetts, the Route 128 region.

Geography played an important role in the concentration of industries. Technology companies initially located near Stanford and its industrial park in Palo Alto, but quickly spread to cities in the south, including San Jose. The boundaries of the peninsula between San Francisco Bay and the Santa Cruz mountains in the west forced a density of development that minimized distance between firms and allowed for frequent informal communications. The resulting dense development facilitated the creation of a technical culture that represented a “loosely linked confederations of engineering teams” [100]. This culture created a flexible system organized around the region and its professional and technical networks, rather than a system organized around any one particular firm.

Informal exchange and communication became increasingly important to the rapid growth in Silicon Valley. The informal exchange was often more valuable than the more conventional, but less timely, communication channels such as industry journals and conferences. Informal communication channels facilitated an extremely high-level of job-hopping as they also functioned as efficient job search networks. The high rates of job mobility forced firms to compete more intensely for technical talent. Geographic proximity of companies also facilitated job mobility, as moving to a new job often proved little to no disruption to personal, professional, or residential ties. Venture capital financing also benefited from geographical proximity, as investors could be directly involved with their ventures, by advising on business plans and

strategies, recruiting managers, and serving on the Board, rather than remotely as was more traditionally done.

Firms in the region entered an economic crisis in the early- and mid-eighties as Japanese manufacturers entered the market with more efficient semiconductor technologies, and the semiconductor became a commodity rather than a specialized product. In the face of this economic competition, industries in the region evolved new business practices. Firms focused on what they did best, and contracted out the rest by locating activities globally to take advantage of each region's unique, specialized offering. Companies "unbundled" by outsourcing activities such as design, manufacturing, testing, marketing, and procurement. The region prospered once again as extensive networks linked contractors, subcontractors, and customers both locally and globally [101].

In the mid-1990s, the region found itself in another crisis, one of its own making rather than brought on by a competing region. Congestion and the high cost of living and doing business were nothing new to the region, but the price of success had become very evident in the late 1990s during the growth of Internet companies. Increasingly, high-tech companies shunned Silicon Valley for places ranging from Montana to Texas. Firms found it difficult to convince workers to relocate when faced with extremely high housing costs. Another detriment to the region is the lack of employee loyalty, a factor that had initially contributed to the Valley's success. Double-digit attrition rates became common in the late-1990s, with most employees having a 24- to 36-month time horizon. Though Silicon Valley has a large, skilled labor pool, it can cost twice as much to hire employees, who are subsequently retained sometimes only half as long. Educational and cultural positives are declining as teachers, artists, public servants, and other non-technology workforce members are being displaced from the area [102].

Figure 5-2 presents a simplified representation of the causal dynamics at work in the development of technology clusters and the problems that they currently face in the region. The figure is an expansion of the "virtuous cycle" presented in Chapter 4 to explain Atlanta's economic growth. In this case, feedback loops are added to represent the dynamics of the system as a combination of positive reinforcing loops and balancing loops. Five loops have been identified in the simplified dynamic map of the region. The first reinforcing loop, R1, explains the initial high growth of businesses and households in the region. The attractiveness of the region for attracting high-tech industries was established early by institutional innovations introduced by Stanford

University. Investment flowed into the region leading to the establishment of more high-tech industries whose supplier and spin-off networks lead to an increasing attractiveness in doing business in the region. The second reinforcing loop, R2, illustrates the other important causes of growth, as the number of high-tech companies grew, the number of skilled workers in the area

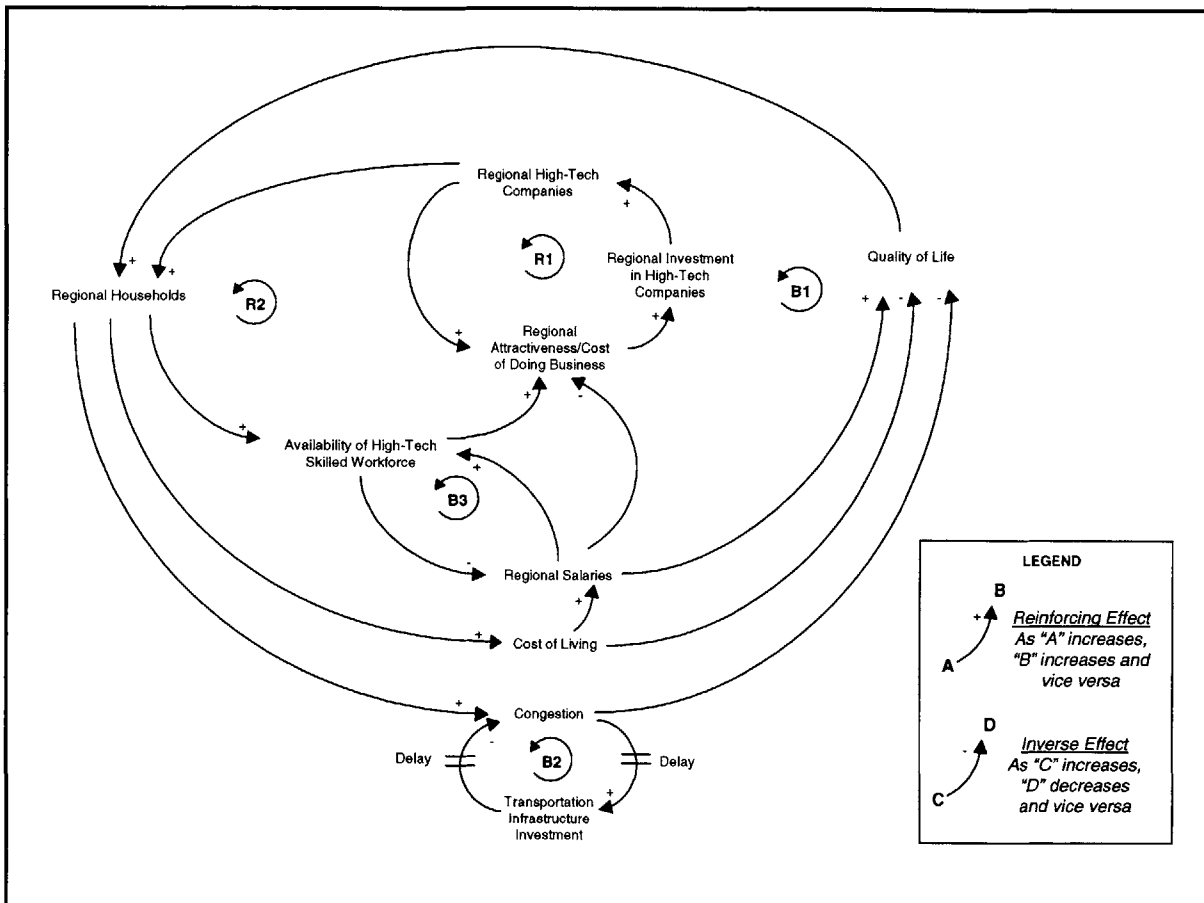


Figure 5-2: Bay Area Cluster Causal Loop Map

establishing their households also grew, increasing the availability of a specialized labor pool and increasing the attractiveness of the region as a place for establishing or relocating a high-tech firm. The initial high growth in both high-tech firms and households is eventually constrained, as shown by the three balancing loops: B1, B2, and B3. The first balancing loop, B1, describes the result of more and more households being established in the region. At first, enough land and infrastructure is available to support a growing quality of life and a growing number of households; so initially loop B1 is weak relative to the reinforcing loops R1 and R2. Over time, the ability of the regional infrastructure to support the growth diminishes and costs rise, reducing the quality of life in the region eventually to a point where households are less attracted to the

area. As the growth in households slows, the reinforcing loop, R2, works to counteract the initial expansion, with a smaller available pool of skilled workers to support high rates of expansion. The next balancing loop, B2, captures an important dynamic in the area reflecting the fact that the region will have difficulty building its way out of congestion. As the number of households increase, congestion increases. After a delay due to time required for projects to be recognized within the regional transportation planning process, new infrastructure is built and growth in congestion levels is eased, but not necessarily reduced. Eased congestion leads to a high quality of life, attracting more households, which in turn increases congestion yet again. The final balancing loop, B3, captures the effect there is upward pressure on worker income both due to increasing costs of living, and the fact that as the availability of the skilled workforce declines from quality of life issues and inter-firm job movement, firms must pay more to attract and retain their workforce. Eventually, the labor rates begin to reduce the attractiveness of the doing business in the region, and balance the high growth rates of firms in the region. Over time, the three balancing loops have the potential of reducing the attractiveness of the region enough that investment in the region will eventually peak, and decline as new capital flows into more attractive regions which exhibit the qualities which initially made the Bay Area successful.

Bay Area Clusters

The dynamics presented in the previous section describe the increasing pressures on the long-term growth prospects for the region in terms of a high-cost of living, higher costs of labor, and traffic congestion. However, the region still experienced a self-reinforcing cycle of economic prosperity in the mid- and late-nineties as broadly represented within the two reinforcing loops of Figure 5-2.

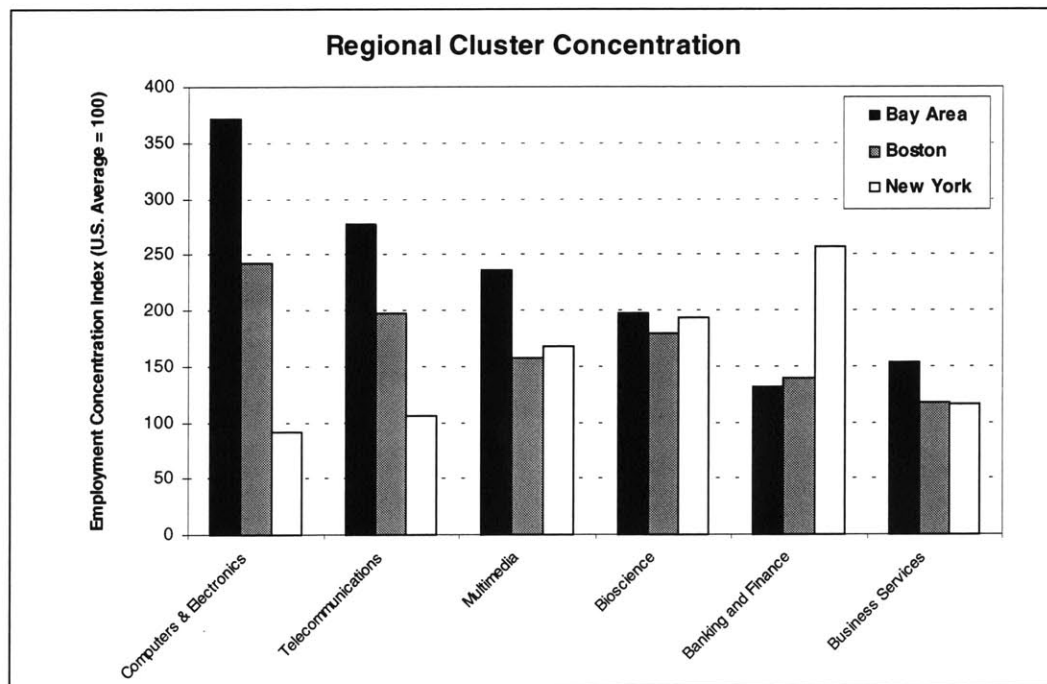
The development of the region's clusters has been path-dependent in that there has been a clear set of historical trends and geographic circumstances directly impacting the specific forms of development that took place. However, as discussed in Chapter 2, the ability of a region to innovate is critical to the sustained development of clusters and competitive advantage. In this area, the Bay Area is a leader nationwide. Measuring innovation by three different criteria shows the region to be the nationwide leader in [103]:

1. 1998 number of patents issued per 1,000 employees -- 2.49, more than 50% greater the second-ranking region, Boston

2. 1998 number of graduate programs in business, engineering, law, and medicine ranked in the Top 10 nationally -- 55 as ranked in U.S. News & World Reports annual survey
3. 1997 research center concentration -- 132 government, industry, and private research centers per million population

In addition to innovation, the concentration of industries and industry productivity of a cluster are important components defining a region's competitive cluster. Given this criteria, there is strong consensus among the economic development organizations within the Bay Area as to definition of the six most competitive regional industry clusters: (1) Computers and Electronics, (2) Telecommunications, (3) Multimedia, (4) Banking and Finance, (5) Bioscience, (6) Business Services.

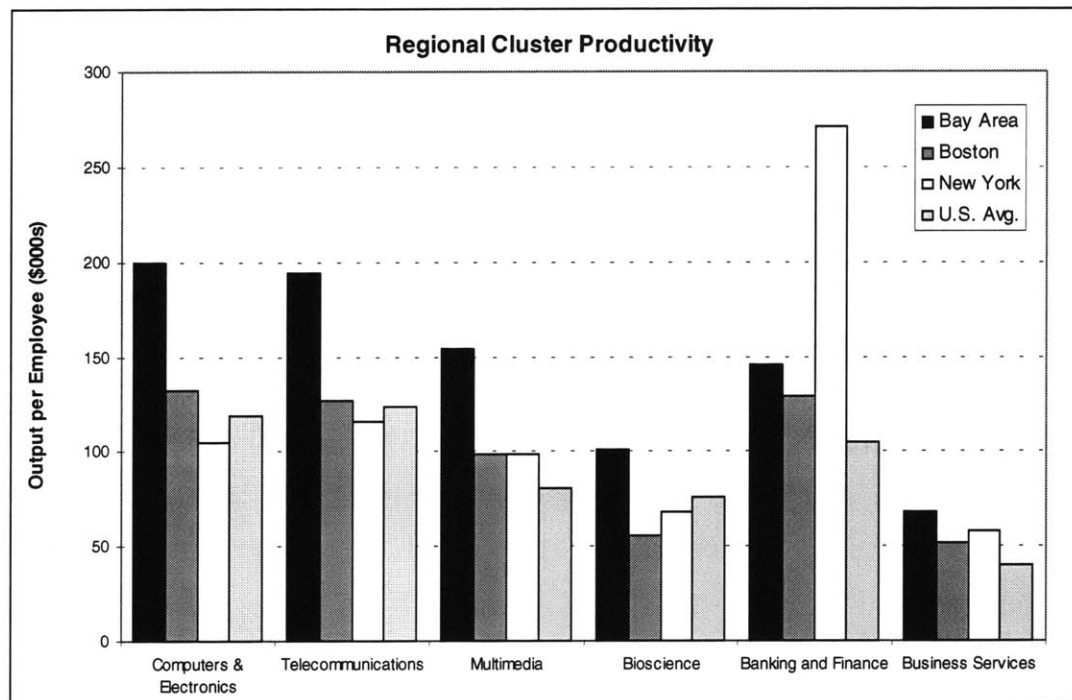
The Bay Area Economic Forum has compared each cluster to its regional competitors and developed measures of their concentration and productivity. Employment concentration, shown in Figure 5-3, is a relative measure, taking the national average of regional concentration of employment by industry as 100 and comparing the each region's specific concentration in relation to this benchmark.



Adapted from: Bay Area Economic Forum, 1999

Figure 5-3: Concentration Index of Selected Regions - 1999

Employment productivity can be measured as a gross-output per employee, or in this case, regional Gross Domestic Product (GDP) per regional employee. As shown in Figure 5-4, the identified clusters are leaders among their peer competitive regions and overall nationwide.



Adapted from: Bay Area Economic Forum, 1999

Figure 5-4: Productivity of Selected Regions

Together, these six knowledge-intensive clusters account for 40% of all jobs in the region [104]. Beyond level of jobs, these industry clusters have used their productivity advantage to act as drivers of economic growth in the region, and the base on which other jobs in the region depend.

Bay Area Economic Development Organizations

The Bay Area has maintained a competitive advantage over other regions despite the challenges of changing technology, and the emergence of potentially lower-cost competitors. Observers argue that the key to success is through not only the existence of physical assets, resources (or even the weather), but also the emergence of socially and institutionally mediated forms of cooperation between regional firms. The interdependencies of the clusters described above are supported by a wider public and private sector which promotes innovation, information exchange, and market-driven forms of local economic development. Business and non-profit organizations play a facilitative role in the development of the linkages between firms. Seven of the most prominent economic development organizations influencing the region are described below,

along with their prominent economic development initiatives as they relate to clusters and regional transportation investment needs.

Joint Venture Silicon Valley (JVSV): This organization is a non-profit network of business, education, and community leaders whose mission is “to identify and solve issues affecting the region to enable all people to succeed in the new economy [105].” In support of this mission, the organization develops and supports efforts to enable sustainable growth and retention of Silicon Valley technology cluster companies and industries by focusing on critical issues facing that community. JVSV has developed an Economic Blueprint for the region which outlines initiatives that would develop economic infrastructure required for retaining, growing and attracting technology cluster-based industries. The initiatives were built around four major objectives: (1) develop specialized infrastructure; (2) reduce the cost of doing business; (3) retain and expand existing industry; and (4) support growth of new industries. The Blueprint found that the economic infrastructure was not meeting the requirements of Silicon Valley firms. In a reversal of prior competitive advantage, Silicon Valley’s labor force, technology base, and quality of life were found to have declined relative to competing regions. In the past, the region was able to compensate for relatively high costs with superior and unique products. However, as the region grew in size, the large number of institutions, jurisdictions, and individuals responsible for regulation, taxes, and other key areas made it more difficult for regional initiatives to be completed quickly. Smaller, less complex regions like Austin, Texas or Singapore were cited as being able to meet rapidly changing needs of companies faster than the Bay Area.

While recognizing the cost of transportation congestion as a contributor to the rising costs and declining quality of life in the region, the Blueprint only formally called for increased transportation investment in support of the region’s Bioscience cluster. The other recommendations for the remaining five regional industry clusters, which were analyzed in depth as to their current economic infrastructure needs, made no mention of additional or improved cluster transportation requirements, while the Bioscience recommendation was vague as to specific transportation improvements needed for the cluster [106]. Additionally, JVSV publishes annually its Index of Silicon Valley report, which measures the economy and quality of life in region. The report measures transportation’s contribution in several ways including (1) percentage of new housing and new jobs located within 0.25 miles of a rail station or major bus corridor, (2) annual growth in transit ridership for the region, (3) percentage of workforce which commutes from outside their county of employment, and (4) percentage of freeway miles

receiving a the worst possible service level rating of “F” during the morning and afternoon peak time periods. The most recent index in 2001 shows that although transit ridership increased in Silicon Valley for the first time in 3 years in 2000, single-occupancy vehicles still represent 80% of the commute trips, while over 30% of the freeway miles received a service level of “F” during peak periods, up from 27% in 1998 [107].

Economic Development Alliance for Business (EDAB): Alameda County established the EDAB in 1990 as a public-private partnership funded by the county, cities, municipalities, and private sector whose mission is to “improve the Bay Area’s business climate by developing and maintaining resources, businesses, good jobs, and a high quality of life [108].” A primary goal of the organization is to develop and enhance resources that businesses might need to compete in the global marketplace. In support of this goal, EDAB released its Economic Development Alliance for Business Transportation report in 1999. The report recognized the growing concern of congestion in the region, and while acknowledging that increased congestion can be a sign of a growing economy, it challenges the ability of the region to sustain economic growth. The findings of the report quantified the costs of congestion at 41,800 hours per day in lost worker productivity, resulting in an estimated \$21 billion annual cost to the county in both lost worker time and fuel costs [109]. To address this problem, EDAB brought together key leaders in the private sector to list the business-related concerns they had about the transportation network and were asked to brainstorm a list of potential solutions to address these issues and concerns. The result was a transportation vision and action plan which was meant to clearly state the interests of the business community. The recommendations were forwarded to the area’s Congestion Management Agency (CMA) responsible for prioritizing projects to be added to the region’s TIP and RTP. The business leaders called for general action items in five areas [110]:

1. Improved advocacy and communication of transportation issues by regional planning authorities: the MPO, state and federal transportation were called on to orient themselves to implementation of congestion solutions based on a comprehensive transportation vision rather than a project-by-project orientation.
2. Strive for a fully integrated multi-modal transportation system: Integration of the regional rapid transit system, BART, and the Alameda County transit agency, AC Transit, into one organization was recommended in order to provide coordinated and connected services.
3. Increased roadway capacity on essentially every major freeway link in the county
4. Improved efficiency of air and sea port operations

5. Better trucking facilities in conjunction with a system of region-wide coordinated delivery time scheduling

Bay Area Council: The Bay Area Council, founded in 1945, is a business-sector sponsored public policy organization representing the business community and dedicated to promoting economic prosperity and quality of life in the Bay Area region. The Council is focused on addressing what it has identified as the three major challenges to the region's business community: (1) increased difficulty of employee recruitment and retention; (2) increased pressure on wages because of lack of affordable housing; and (3) employee productivity lost from escalating traffic congestion. In support of the third issue, the Council has adopted a transportation action plan which broadly calls for more efficient use of existing transportation investments and strategic investments in new capacity. The Council's most aggressive transportation policy has been the advocacy of a new high-speed water transit system in the Bay Area as the centerpiece of efforts to improve mobility in the region and to maintain economic vitality. The initiative has the support of the California State Senate which passed a resolution in the late-1990s supporting the effort and directed the region to form a Blue Ribbon Task Force to create a implementation plan for presentation to the legislature [111].

Association of Bay Area Governments (ABAG): ABAG is a public agency owned and operated by the 100 cities and 9 counties of the San Francisco Bay Area. It was established in the early-sixties to promote cooperation on area wide issues. Each member city and county designates a representative to serve in the Association's General Assembly. The Assembly appoints regional planning working groups including various joint committees with the Metropolitan Transportation Commission, the region's MPO [112].

Bay Area Economic Forum (BAEF): The organization is a non-profit, public-private regional partnership of business, government, academic, labor, and community leaders including the Bay Area Council and Association of Bay Area Governments. The mission of the organization is "to foster an outstanding environment in the region of a competitive economy to thrive and to enhance the overall quality of life in the nine-county Bay Area [113]." The organization regularly convenes workshops of key industry and community leaders to discuss constraints inhibiting the growth of the region's six clusters. BAEF has been a regional leader in identifying and studying the region's core group of industry clusters. In 1999, the organization released an extensive study examining the economic performance of the Bay Area clusters with comparable

regions and clusters nationwide. The results of the study concluded that the future success of the Bay Area clusters rested on their ability to continue to attract a highly skilled workforce through its business opportunities, high quality of life, and innovation infrastructure. The report suggested that the Bay Area competitive advantage over other regions is being eroded by the cost of doing business. BAEF highlighted the fact that a significant portion of Bay Area workers live in one county and commute to another country to work, and ranked the region's transportation infrastructure quality and congestion as inferior to its peer competitive regions [114]. From a transportation policy perspective, the organization is most heavily involved in assisting the Bay Area Council with its high-speed water transit initiative and in studying the impact of air transportation on the Bay Area economy, the results of which are discussed further in Section 5.1.2.

California Technology, Trade, and Commerce Agency: The agency serves as the Department of Commerce for the State of California. Multiple economic development programs and divisions are responsible for supporting the department's goal of "continually creating jobs and increasing economic investment for Californians, both domestically and in the international business area [115]." A recent addition to the agency is the creation of the California Infrastructure and Economic Development Bank. Created in 1994 to promote economic revitalization and enable future development, the Bank has the broad authority to issue tax-exempt and taxable revenue bonds to provide low cost financing to public agencies for a wide variety of infrastructure and public improvements. Highways, port facilities, and public transit are eligible for funding. Projects are prioritized based on a scoring criteria specifically tied to economic development potential of the project. Criteria among which points are awarded include: (1) the project's job creation/retention per dollar of financing; (2) the project's ability to create/retain jobs within the region's core economic base of employers or clusters; (3) demonstrated clear relationship to the project region's economic development plan and the proposed project; and (4) demonstrated improvement to the quality of life for the project region's residents [116].

Of all eight metropolitan regions and states surveyed within this thesis, the Bay Area has, by far, the most numerous and active economic development organizations. The region does not have any "official" proactive cluster initiatives, but instead, the clusters are self-aware and have extensive networks of support institutions working on their behalf. The Bay Area is also unique in the almost unanimous recognition of the important role transportation infrastructure can play in cluster growth, in this case, as a constraint due to the high levels of congestion throughout the

Bay Area transportation system. Although each economic development organization devoted a general policy towards congestion relief, some even highlighting specific corridors for improvement, it is significant to note that none of the organizations focused on specialized transportation needs on a cluster by cluster basis. Instead, transportation issues were seen more broadly, and general solutions were proposed.

5.1.2 Regional Transportation Planning

Transportation Regional Infrastructure Overview

The regional transportation infrastructure for the Bay Area is depicted in Figure 5-1 and encompasses nine counties, 101 municipalities, over a 7,179 square mile area. The transportation network includes 1,400 miles of highways, 308 miles of carpool lanes, eight toll bridges, 19,000 miles of local streets, 7,000 miles of transit routes, six public sea ports, six commuter ferry lines, and three major commercial airports. In all, \$4.4 billion in public funds are spent annually on transportation in the region [117]. Transportation planning at a regional scale in the Bay Area is an enormously complex issue, and in response, the MPO responsible for this effort, the Metropolitan Transportation Commission (MTC) is associated with an extensive regional architecture to manage the operation and planning for the regional network.

MTC Structure and System Management

The MTC was created in 1970 by the California Legislature to plan the transportation network for the nine Bay Area counties. Its primary responsibilities include:

1. Development or updating of the Regional Transportation Plan every two years
2. Allocation and accounting of mass transit, highway, freight facility, and pedestrian/bicycle routes in the region, as well as the collection and administration of tolls on all regional toll bridges.
3. Transit operation in order to fill in the gaps of the regional public transportation system including, for example, the bus service from the current terminus of the BART network in Colma to San Francisco International Airport (SFO) [118].

The second responsibility is a characteristic unique to the U.S. transportation planning process in that the MTC is authorized under state law to be the designated recipient of a major percentage of the federal and state highway funds available to the region. This institutional characteristic

provides the unique opportunity for the MPO to play a strong leadership role, transcending strictly a coordination function, in the transportation planning process.

The MTC has a 19-member commissioner panel meeting each month to discuss and vote on regional transportation planning issues. Fourteen commissioners are appointed by local elected officials and serve four-year terms, with the most populated counties allocated two commissioners each. The remaining commissioners are from ABAG, the San Francisco Bay Conservation and Development Commission, the State of California's Business, Transportation, and Development Agency, the U.S. Department of Transportation, and the U.S. Department of Housing and Urban Development [119].

To manage the transportation system owned and operated by many different agencies and organizations, MTC has formed coalitions with over three-dozen federal, state, regional, and local institutions responsible for implementing the transportation and environmental quality in the Bay Area. The coalition is known as the Bay Area Partnership and among those included are the California Department of Transportation (Caltrans), airport and seaport operators, and 26 regional transit operators. The Bay Area Partnership has three operating committees – the Plans and Programs Committee, the Legislative Committee, and the System Operations and Management Committee. The MTC is responsible for coordinating the partnership and committees and providing staff support for technical analysis and administration. Additionally, the MTC Advisory Council provide opportunities for involvement by business, community, labor organizations, academics, transit users, the freight community, the elderly, and the general public [120].

Further institutional arrangements involve a Memorandum of Understanding (MOU) between the MTC, ABAG, and Caltrans through which they agree to share land use and transportation forecasts. The MTC, ABAG, and Bay Area Quality Management District have a MOU in which they agree to work together to prepare and update air quality plans to meet federal requirements. Finally, the Regional Transit Coordinating Council (RTCC) administered by the MTC establishes coordination of transit service, financial planning, and regulatory activities for the conduct of short-range transit planning services [121].

At a system-wide level, the MTC has increasingly sponsored projects that aim to provide consistent service to transportation users region-wide. The earliest projects were the

administration of call boxes and roving freeway tow trucks for incident management. These efforts have expanded to include regional real-time traveler information systems, and a single transit information telephone number. Upcoming projects include TransLink, a smartcard technology integrating fare collection for all of the region's 26 transit operators [122].

The MTC has also supported project development at the corridor level in its efforts to promote a comprehensive transportation systems management framework established in 1993 and integrated into the current RTP. The MTC increasingly concentrates on multi-jurisdictional projects at the corridor level. By focusing at the corridor level, the framework is able to capture vehicle- and person-flows that require cross-jurisdictional integration necessary to plan and operate highways and transit services as a single system. The 1998 Bay Area Regional Transportation Plan places the region's long-term investments in the context of 16 identified travel corridors, rather than dividing the region into its nine county components. While the corridor framework may be a logical unit from which to manage a transportation project, it is still often mismatched with existing institutional structures that better match political and transportation modal boundaries. Currently, the MTC is forced to act as a project champion while attempting to fund region-wide projects which cross fragmented jurisdictional boundaries typically resulting in funding opposition [123].

MTC Transportation Planning

Ideas for transportation projects emerge from planning efforts at the city, county, transit operator, and regional levels. However, in general, the major sources of projects considered for the long-term regional transportation plan are the Congestion Management Plans and Short-Range Transit Plans. Funded and unfunded projects are incorporated under various plans throughout the planning process, the most important of which are summarized below:

Congestion Management Plans: The California State Assembly created a county level transportation planning unit called Congestion Management Agencies (CMAs). Each CMA is responsible for preparing and implementing county level transportation plans, called Congestion Management Plans (CMPs). The CMPs serve as the base projects for consideration in the development of the RTP.

The Regional Transportation Plan (RTP): The development of the current RTP was based originally on three alternative policy options: (1) Option A based on addressing prior

commitments and local plans, (2) Option B based on system maintenance and operating management, and (3) Option C based on coordinating transportation and land use. In the planning process, consensus was reached within the MTC that all three options were complimentary and necessary to some degree, resulting in the merging of all three options into the current RTP. Notable in the context of this analysis, is the absence of economic development from the explicitly stated alternative policy options. The resulting major focus of the current plan, adopted in 1998, is the maintenance, operations, and management of the existing transportation system. Rather than responding to growth with major new infrastructure projects, the 1998 RTP focuses on maintaining and improving existing highway and transit systems. Consistent with ISTEA and TEA-21 requirements, the RTP includes only projects that the region can afford and the projects, taken as a whole, are not planned to worsen air quality. Additionally, state law requires the MPO to address regional issues not covered by the county-jurisdiction constrained CMPs.

Transportation Blueprint: The MTC also leads a regional effort known as the Bay Area Transportation Blueprint which evaluates various strategies to improve the region's transportation network. These improvements are typically beyond the financial resources of the MTC and therefore not included in the RTP which includes only projects for which funding sources have been identified. The Blueprint serves as a means to link together funded and unfunded projects into a single document and planning framework. The current Blueprint document identifies over \$3.8 billion worth of unfunded transportation needs in the region, and focuses primarily on providing medium-term relief in the region's most congested travel corridors. The Blueprint covers high-profile projects such as the extension of BART from Alameda County into the heart of Silicon Valley in San Jose and the upgrading of the Caltrain commuter express network into a high capacity, high-frequency service [124].

Governor's Traffic Congestion Relief Plan: Released in April 2000, this statewide plan proposed the release of \$5.3 billion in efforts to reduce Statewide congestions funded by a mixture of general state fund revenues and sale tax resources. Under this plan, the Bay Area's share is approximately \$1.6 billion, 90% of which is dedicated to the funding of public transit improvements. The Economic Blueprint provided a framework from which to allocate the proposed new funds [125].

Short-Range Transit Plans (SRTP): Annually, each of the twenty-six Bay Area transit operators is responsible for developing a SRTP which describes the service and financial plans, and capital improvement programs for each transit service. The multiple SRTPs serve as the initial base of transit projects for the RTPs, and provide input for the TIP planning process.

Major Investment Studies (MIS): The Bay Area Partnership, the coalition of transportation organizations coordinated by the MTC, is responsible for identifying projects requiring MIS. The guidelines within a MIS provide the basis for investment decisions which subsequently appear in the RTP and TIP. The development of the MIS includes measures of project efficiency including cost-effectiveness, financial feasibility, and equity. No mention of economic development measures are found within the MIS development guidelines [126]

Transportation Improvement Plan (TIP): The MTC has a screening process for projects to be included in the short-range TIP, based on a scoring criteria given to projects proposed through the CRP, SRTP, MIS, and other MTC coordinating activities. The scoring criteria do not include any economic development evaluations. Consistent with ISTEA and TEA-21 requirements, only projects consistent with the RTP are included in the TIP. Additionally, even fully funded projects will be excluded by the MTC if they are inconsistent with its RTP [127].

Freight Advisory Council Reports: The Freight Council was established to obtain advice on freight issues and help identify and implement effective strategies to improve freight mobility in the Bay Area. Representatives of the Freight Advisory Council also sit on the MTC Advisory Council.

Regional Airport System Plan (RASP): The Regional Airport Planning Committee (RAPC) serves as an advisory committee to the MTC and is responsible for developing the RASP. The RASP is a rolling plan periodically updated since 1972, providing analysis and policy guidance on aviation requirements for commercial and general aviation airports in the region. The plan is an informational document and focuses on forecasts of demand and environmental concerns [128]. Because the plan does little to address the economic impact of airport investment, especially the economic cost of inaction, economic development organizations in the region have completed their own studies on the system and submitted the recommendations to the MTC.

The Bay Area Regional Transportation Plan and Economic Development

The current Bay Area RTP was examined to evaluate its incorporation of economic development issues within its planning framework. Because of the presence of such a large number of economic development organizations within the region, and the consensus from each organization that increasing congestion was reducing the area's competitive advantage, it was expected that the RTP would incorporate to some degree the concerns within the planning document.

The RTP viewed the transportation network as a system of multi-modal travel corridors constituting the most relevant subdivision of the network. For the 14 corridors identified, five general goals were established for the planning of each, goals which closely mirrored the planning factors within the TEA-21 framework. For each corridor, the RTP listed the efforts to "support the economic vitality of the region [129]." No definition was given within the plan as to what constituted economic vitality, nor were any performance measures established. The following table summarizes the 14 corridors and the generalized initiatives to support the economic vitality of the regions impacted by the corridor. As shown in Table 5-1, the RTP primarily focuses on the need to prevent midday congestion for freight traffic.

In 2000, the California State Assembly passed a bill encouraging the use of transportation system performance measures in the development of future Regional Transportation Plans. In response, the MTC commissioned a study by the Institute of Transportation Studies at University of California Berkeley to evaluate performance measures including economic vitality. The study recommended three performance measures for economic vitality which are summarized below:

- *Change in Travel Time for Origin/Destination (O&D) Pairs:* This measure applies for O&D pairs specifically chosen to reflect regional goods movements. Examples of these pairs would include manufacturing and distribution centers, seaports, and airports.
- *Mobility Measures:* Mobility measures related to travel time and delay or congestion for work trips were chosen to acknowledge the general impact of mobility on the economy.
- *Shippers/Business Survey of Regional Transportation:* The survey will monitor and reflect the attractiveness for the business in the region and will attempt to measure changing cost impacts to regional industries.

RTP Planning Corridor	Summary of Stated RTP "Economic Vitality" Issues for Corridor
Golden Gate Corridor (U.S. 101 Vicinity)	<ul style="list-style-type: none"> - Improvements of U.S. 101 and the Northwest Pacific right-of-way are seen as key to serving economic growth in Sonoma County - Spreading duration of congestion on U.S. 101 impairs truck mobility in the midday - Spreading congestion on the weekends impairs access to recreational destinations
North Bay East-West Corridor (Route 12 and Route 37 Vicinity)	<ul style="list-style-type: none"> - Improvements that support eco-tourism (wetlands, waterfowl observation, and wineries) and agriculture are important to the area's future vitality
Napa Valley Corridor (Route 29 and Route 121 Vicinity)	<ul style="list-style-type: none"> - Conflicts between local agricultural truck traffic and other traffic can be addressed through selected operational improvements - Tourism is a key to the areas economic vitality, and the economy will benefit from good accessibility to other parts of the Bay Area
Interstate 80 Corridor (Port of Oakland Vicinity)	<ul style="list-style-type: none"> - As a major freight corridor, traffic should be managed to ensure smooth operations on I-80 during the midday for trucks - Growing congestion on I-80 will require improved transit connections to maintain access to jobs in the urban core - Improving rail service to the Port of Oakland through the Joint Intermodal Terminal could help enhance economic competitiveness of the port
State Route 4 Corridor (Route 4 Vicinity)	<ul style="list-style-type: none"> - Spreading duration of congestion on Route 4 could impair truck movements. As a major freight corridor, it will be important to ensure reliable operations during the midday for trucks.
Interstate 680 Corridor (Contra Costa County Vicinity)	<ul style="list-style-type: none"> - Spreading duration of congestion on I-680 could impair truck movements in the mid-day. Traffic should be managed for reliable operations during the midday for trucks - Access to major retail centers is critical to the economic vitality of the area
Interstate 580 Corridor (Central Valley to Alameda)	<ul style="list-style-type: none"> - Spreading duration of congestion on I-580 could impair truck movements. As a major freight corridor, traffic should be managed to ensure efficient truck operations during the midday. - As a growing suburban employment center, good local and regional access to jobs is important
Interstate 680 South Corridor (Alameda to Santa Clara Vicinity)	<ul style="list-style-type: none"> - Traffic growth in the corridor could effect efficient truck operations during the midday - Corridor is critical to the economic vitality of Silicon Valley
Interstate 880 Corridor (Oakland Intl Airport Vicinity)	<ul style="list-style-type: none"> - As a major trucking facility, spreading congestion on I-880 could impair freight operations during the midday - Efficient ground access to the Port of Oakland and Oakland International Airport is critical for the region
Fremont-South Bay Corridor (Southern Alameda County to downtown San Jose Vicinity)	<ul style="list-style-type: none"> - Because of the importance of accessing jobs in Silicon Valley, this corridor is important to the economic vitality of the region - Reliable freeway operations need to be maintained during the midday for trucks
Santa Clara Sub-Area (Silicon Valley Vicinity)	<ul style="list-style-type: none"> - Preserving the accessibility of Silicon Valley and other high-tech companies along I-880 is critical to the economic vitality of the region - Growth management concepts for the southern county can be coordinated with transportation investment - Transportation plays a major role in the economic vitality of downtown San Jose - Good ground access to San Jose International Airport is important due to the large amount of business travel
Peninsula Corridor (San Francisco Intl Airport Vicinity)	<ul style="list-style-type: none"> - Spreading duration of congestion could impair truck movements - Maintaining good ground access to SFO is critical to the local and regional economy
San Francisco Sub-area	<ul style="list-style-type: none"> - Regional transportation projects need to be closely coordinated with city redevelopment plans - Efficient truck access to downtown is critical - Improving multi-modal access is important to the Presidio - Transportation services that serve the city's tourist and recreational travel market must be maintained
Trans-bay Corridor (San Francisco Bay Bridges)	<ul style="list-style-type: none"> - Trucks need reliable operation on bridges during the midday - Good access to I-580 is critical to the economic development in the city of Richmond

Source: MTC, 1999

Table 5-1: Economic Vitality Components of the Bay Area RTP

The report also includes measures that were evaluated but not recommended for inclusion in the 2001 Bay Area RTP. These measures included the economic cost of congestion, number of industries relocating out of the region, delay per ton-mile traveled, and jobs directly created by transportation investment. The measures, though beneficial for measuring the impact of transportation on the competitive advantage of the region, were rejected due to the complexity of calculation or the impact of exogenous factors that were not a clear outcome of transportation investment [130].

Bay Area Regional Airports and Economic Development

The Bay Area has three international airports which contribute to the global competitiveness of the region. These airports are Oakland (OAK), San Francisco (SFO), and San Jose (SJC). In 2000, both the MTC and FAA were evaluating projected capacity demands and alternatives to meet them, but no formal regional inquiry was being undertaken into the airport economic impacts. Concerned that the regional economic costs of inaction were not being fully considered, The economic development organization, the Bay Area Economic Forum (BAEF), commissioned a study on the overall economic impact of the Bay Area airports and its impact on regional competitiveness.

The project was divided into two phases. The first phase estimated the local economic impacts of the airport in terms of the direct impacts of the airport on airport related jobs, visitor spending, and revenue generated from airport revenues. The second phase looked at the competitive impacts of the airport related to regional businesses. Given the region's knowledge-based industry clusters, there is a strong dependence on air travel. For example, a Bay Area company may need to compete against firms in Texas, Germany, and China, by forming strategic alliances with companies in Japan and Mexico and by drawing skilled workers from India and technology for the Netherlands. Bay Area clusters also need the ability to express documents and time-sensitive parcels in a timely manner to customers and business partners. BAEF estimated that 4.4 million passenger hours were lost in 1999 in Bay Area airport terminals, taxiing on runways, and holding patterns [131]. Estimating the lost productivity and economic impact is not straightforward. Some regional economic gain is found in the short run with delays as increased airport dwell times lead to higher expenditure per passenger in the airport terminal. Less well-understood are the subsequent medium-to-long term decision by businesses and individuals when faced with repeated flight delays and cancellations.

BAEF surveyed business executives and frequent air travelers from each of the six industry clusters regarding their airport concerns. Though the survey did not disaggregate concerns by cluster, it provided interesting insight into the competitive impact of airport delays and congestion. Most executives surveyed indicated that they tended to locate their offices in the Bay Area in proximity to their perception of where their identified labor force were living or wanted to live, rather than proximity to the regional airports [132]. This result suggests industry clusters are still making location decisions based on workforce needs, rather than transportation infrastructure needs, thus improving airport access will have marginal impact on relocation decisions by cluster firms.

A relatively small number of Bay Area business clusters surveyed said they were heavily dependent upon air freight transportation services in and out of the Bay Area. Most industry clusters use freight forwarders and cargo consolidators to arrange door-to-door transportation services. These forwarders reported no problems making delivery deadlines due to regional airport delays. In fact, the largest forwarders stated that they used Los Angeles (LAX) as the primary air freight gateway, with Portland and Seattle as fallback airports. The benefits to this approach were due to the wider choice of services and schedules and the efficiencies gained by consolidating northern and southern California cargo into one location. Overnight shipment from the Bay Area to LAX provides the ability for cargo to be loaded onto mid-afternoon departures bound for domestic, Asian, or European destinations [133].

The final finding of the cluster survey attempted to assess the qualitative impact of delays. Nearly half of the industry cluster executives surveyed stated that a delay of less than an hour had little to no critical impact on their business, while 31% believed it had some impact, and 18% believed it created a real loss of productive time. In contrast, the 62% saw a delay of 2 hours or more as critical [134]. The vast majority of delays experienced by Bay Area airports are 1 hour or less. While airport delay studies tend to aggregate total hours of delay experienced by passengers and multiply it by a value-of-time figure to estimate economic impacts of delay, this survey example suggests that the economic impact in terms of regional competitive advantage is minimal.

Figure 5-5 summarizes the multiple economic development and transportation institutions for the Bay Area. Sections 5.1.1 and 5.1.2 described some of the institutional links between the four sectors listed below.

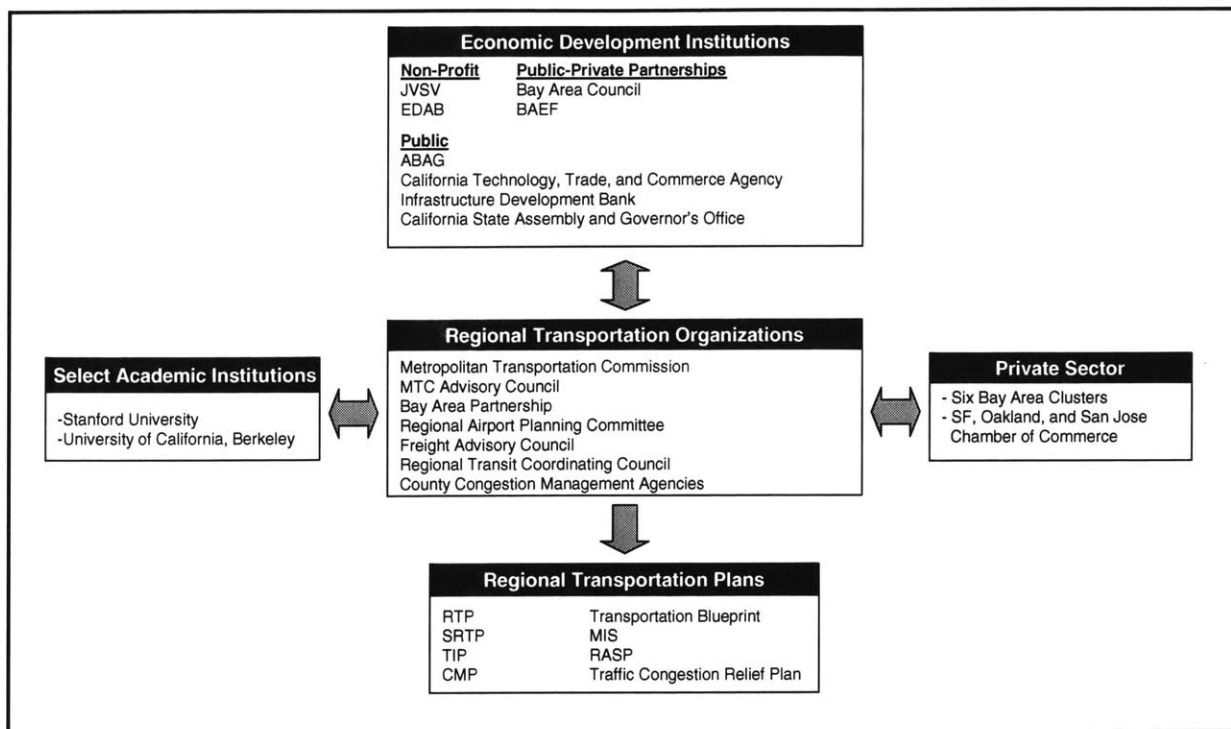


Figure 5-5: Bay Area Transportation and Economic Development Institutions

5.1.3 Regional Summary

Silicon Valley is perhaps the best example of a working cluster in the United States. A strong network of economic development organizations provide support for the region's clusters, with most organizations citing traffic congestion as one of the three major constraints on the continued development of its clusters (the other two constraints being a skilled worker shortage and rising housing costs). Bay Area economic development organizations have been very proactive in commissioning their own transportation studies and reporting their findings to the MTC, the region's MPO. Cluster-specific transportation needs are usually not cited in these studies, although transportation issues are highlighted as broadly impacting all clusters. The one example of cluster-specific needs assessment, performed by the BAEF, found surprisingly that congestion and delay at SFO airport was at most impacting clusters negatively in the second order relative to other regional concerns. The region's main "report card" on the health of its clusters, published annually by JVSF, includes transportation measures as one of its seven metrics.

Although the regional MPO has many links to the economic development representatives in the Bay Area, the MTC's RTP does not incorporate cluster-based development to any significant

degree. Instead, the RTP focuses more broadly on the TEA-21 guiding principle of “economic vitality,” and approaches congestion concerns more from the perspective of freight traffic and the need to prevent midday congestion. For the development of the 2001 RTP, the MTC has been directed by the California State Assembly to use specific performance measures for economic *vitality*, but the recommended measures do not include any economic *development* metrics such as productivity growth or cluster-specific performance criteria.

5.2 Twin Cities, Minnesota

5.2.1 Regional Economic Development and Clusters

Economic development in the Twin Cities region has evolved substantially over the past 30 years. In the 1970s and 1980s, economic development consisted of bidding wars with other states in an effort to lure large manufacturing plants to the region. For example, in 1985, the State of Minnesota offered over \$1 billion in tax-incentives in an effort to lure Saturn (GM) to the state but ultimately lost the manufacturing center to Tennessee. In the early 1990s, the economic development strategy shifted to investing in important local companies. During this period, the state extended a low-interest credit line to Northwest Airlines to help the company avoid bankruptcy, and protected retailer Dayton Hudson from a hostile takeover. In the early- to mid-1990s, the region experienced a policy shift to industry clusters [135].

The region’s city governments currently have a substantial role in what is considered economic development efforts. The focus of most of these municipal efforts tends to be on jobs for the specific city and tax base, rather than development for the region as a whole. The true economic region has spread across twenty counties and spilled across the state border into Wisconsin. Like most regions, the political jurisdiction of the Twin Cities is not currently reconciled with the boundaries of the real economic region.

In the mid-1990s, the region undertook one of the nation’s first comprehensive regional industry cluster studies. The Twin Cities Cluster Study was undertaken by the Metropolitan Council, the region’s MPO, to enhance the understanding of why certain industries succeed in the Twin Cities region. Participants included the Center for Transportation Studies at the University of Minnesota, local economic development organizations, Metropolitan Airports Commission, the Minnesota Department of Transportation (MnDOT), private railroad firms, and industry leaders. Noticeable is the absence of the Minnesota Department of Trade and Economic Development.

The study identified four clusters and a follow-on study added an additional fifth cluster to the region, which will be discussed below. The clusters were identified using aggregate U.S. Department of Labor standard industrial classification system (SIC) and determined the location quotients for each regional industry (Section 2.3.5 discussed the cluster identification process and the hazards of using the aggregate SIC codes). The study analyzed each of the clusters identifying the factors leading to the clusters competitive advantage as well as identifying specific cluster needs to sustain their advantage. Except for the Financial Services cluster, transportation infrastructure was not cited as a critical need for any specific cluster but was mentioned as a factor condition leading to the development of some of the clusters. Additionally, the report's broad forward-strategies included the recommendation to "incorporate economic development considerations into transportation decision-making process [136]." The Twin Cities' five industry clusters, and their transportation-related factor conditions as identified by the report, are described below:

Printing and Publishing Clusters: This cluster is perhaps the region's strongest local cluster in terms of national market share of industry employment. There are no easily identifiable firms or institutions which served as the driving force behind the emergence of this cluster, and the region ranked fifth among America's printing clusters in employment share behind Chicago, Los Angeles, New York and Philadelphia [137]. The central location of the Twin Cities was identified as an advantage for printing and publishing companies pursuing the national market. Freight services, shipping costs, and turnaround times are important determinants of profit for this cluster. The central location on the continent with excellent north-south and east-west interstate connections for trucking firms and a major airline hub give the region's cluster some competitive advantage over other areas.

Computer and Software Cluster: Less known than its competitive counterparts in Silicon Valley and the Boston Route 128 region, the Twin Cities nevertheless has a strong concentration of technology firms. Although the region has no single large cutting-edge software or hardware developer, it does have a diverse range of specialized software firms. Transportation infrastructure was not cited as a factor condition for this cluster.

Medical Devices Cluster: With firms such as Medtronic and Guidant producing the major share of the nation's pacemakers, and 3M's extensive medical component division, the Twin Cities' medical device cluster is referred to as "Medical Alley." The Northwest Airlines hub in Minneapolis was cited as a contributing factor condition by providing the cluster's ability to ship

products nationally overnight. Air transportation's importance is further emphasized by the fact that Medtronic was Federal Express' second largest customer in the nation as Medtronic sought a competitive advantage by having its pacemakers implanted with the freshest possible batteries [138].

Machinery and Metalworking Cluster: This high-export related industry contributes over \$1.5 billion annually to the region's export base and is made up of a diverse collection of small firms. Transportation was not specifically cited as a factor condition to the establishment of a competitive advantage for the cluster, but is implicitly assumed due to the export-related nature of the cluster.

Financial Services Cluster: Transportation infrastructure was cited as a key determinant of the formation of this cluster. The Twin Cities' historical status as a railroad terminus helped centralize the financial services of the Upper Midwest region, including the Ninth District Federal Reserve Bank, into the Twin Cities' area. The region is also situated so that its airline hub infrastructure can provide access to the entire nation in generally less than four hours of flight time. The frequency of hub city service combined with the convenience of the Twin Cities airport, less than 10 miles from both downtowns, provides financial services easy access to national and international markets. The cluster study recommended that in order to preserve the competitive environment for financial services, the region should focus strategic investments in a healthy public transit system. A strong public transit system was seen as necessary to increase the attractiveness of the typically labor-intensive financial service firms as places to work, particularly for low-wage workers who could not afford a private automobile.

Beyond the original cluster study by the MPO, Twin Cities' regional economic development organizations have produced a significant body of literature of strategic initiatives to develop and expand the regional economy. The most prominent studies were surveyed to assess the role transportation infrastructure was seen to play in the regional economic development policies. The results of this survey are shown below in Table 5-2.

Economic Development Study	Role of Transportation Infrastructure
Minnesota Business Partnership. <u>Enhancing Minnesota's Economic Competitiveness: An Industry Specific, State-Specific Approach</u> , 1992.	Improved transportation infrastructure was not identified in the study's recommendations
Greater Minneapolis Chamber of Commerce. <u>Building Our Future: Regional Strategies for Economic Opportunities</u> . 1995.	Study cited the existence of transportation infrastructure as a component of economic development. However, of 26 economic development strategies put forth, investment in transportation infrastructure was not one of them
Economic Development Association of Minnesota. <u>Strategies for Economic Growth: Minnesota's Economic Development Investment Priorities</u> . 1997	The study was the compilation of a survey of 1,000 economic development professionals listed a key concern of economic development in the region to be the ability of an increasingly congested transportation infrastructure to limit growth. While the study recommended the investment in public transportation as a foundation for economic growth, transportation infrastructure was not included in the top three priorities
Metropolitan Council. <u>Maintaining Our Competitive Edge for the 21st Century: State of the Region</u> . 1999.	Report questioned the shortage of available transit in the region, but no explicit link transit to economic development
1000 Friends of Minnesota. <u>Two Roads Diverge: Analyzing Growth Strategies for the Twin Cities Region</u> . 1999.	The study calculated the economic costs of two regional growth scenarios: smart growth and sprawl. Transportation infrastructure costs were included as a component
The Great North Alliance. <u>Opportunity Forecast</u> . April 2000.	Study compared the Twin Cities economic performance to that of Atlanta, Boston, Chicago, Austin, and Seattle. Transportation infrastructure was not cited in the comparisons nor as a need to improve economic performance
Citizens League. <u>Securing Minnesota's Economic Future: A New Agenda for the New Economy</u> . 2000.	The study promoted the shift of regional economic development efforts from job creation to improving productivity. Public transit investment was seen as a contributing factor to productivity improvement, but transportation investment was not cited in the final list of detailed short-term priorities
Office of the Governor. <u>The Big Plan: Strategic Directions of the Venture Administration</u> . 2000.	The plan focused on strategies to improve the regions status as an overall global competitor. Telecommunications and telecommuting were cited as infrastructure investments necessary to facilitate this improvement, but transportation investment was not mentioned

Table 5-2: Survey of Transportation Needs Cited in Economic Development Studies

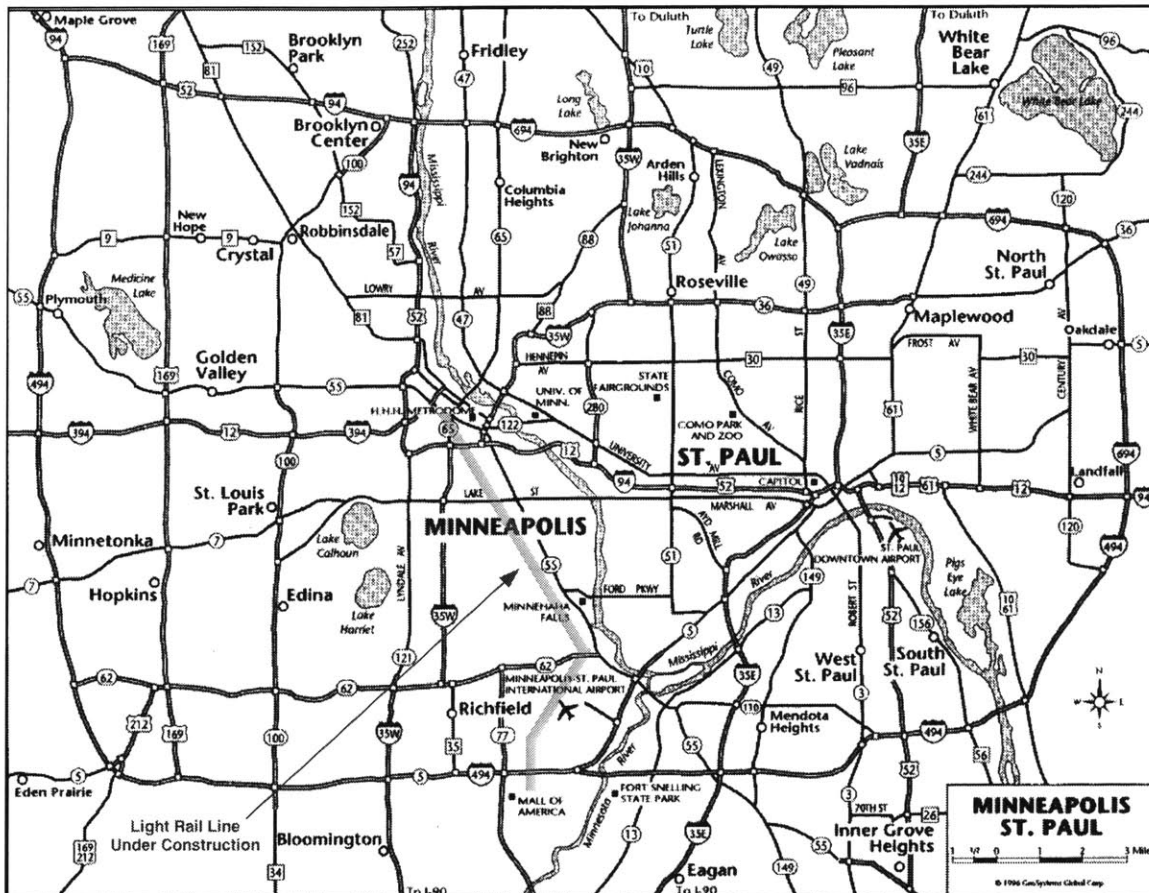
In contrast to the Bay Area where transportation needs were a prominent policy action item in each plan reviewed, the Twin Cities economic development studies all but ignore transportation investment as a supporting strategy in the promotion of economic growth in the region. There may be several explanations for this, not least of which are the facts that the Twin Cities does not currently face the same levels of traffic congestion, airport congestion and delay, or geographic constraints.

Overall, the Twin Cities use of industry clusters as a policy tool to guide economic development may be characterized as limited. The efforts have not fully coordinated the government agencies, private industries, and academic research institutions; instead cluster policy efforts have focused on nudging the existing clusters toward further developing their competitive advantages.

5.2.2 Regional Transportation Planning

Because of the absence of physical boundaries, such as a coastline or a mountain range, the Twin Cities metropolitan area is distinguished by a very low population density and rapid geographic expansion. The seven-county Twin Cities region is the third least dense or “most sprawling” of the 25 largest metropolitan areas in the U.S., behind only Atlanta and Kansas City [139]. The Twin Cities metropolitan area is made up of 272 separate local government units: seven county governments, 138 cities, 50 townships, 49 school districts, 22 special purpose jurisdiction, and six metropolitan government agencies. The center of the region is shown in Figure 5-6, highlighting the transportation network within the cities of Minneapolis and St. Paul.

The Metropolitan Council was established in 1967 to coordinate the comprehensive planning and development of the seven-county Twin Cities region. The Governor appoints seventeen representatives from districts of roughly equal population and each serves four-year terms. The Metropolitan Council is empowered by the State to prepare and adopt a comprehensive development guide for the Twin Cities. The guide includes direction for land use, parks, airports, highways, transit services, schools, hospitals and other public buildings. The Council also serves as the MPO for the region and the lead agency for implementing ISTEA and TEA-21 transportation planning requirements. The other major participants in the transportation planning process are the Metropolitan Airports Commission (MAC), the Regional Transit Board (RTB), and the Minnesota Department of Transportation (MnDOT). A Transportation Advisory Board (TAB) is also administered by the Metropolitan Council and is responsible for assigning transportation funding priorities and adopting programs. The TAB has 30 members representing local municipalities, state and regional agencies, and the public.



Source: GeoSystems Corporation

Figure 5-6: The Twin Cities

The regional transportation planning process begins with the creation of the regional development guide, known as the Regional Blueprint. The Blueprint is divided into four chapters dealing with transportation, aviation, wastewater, and regional recreation space. The Transportation Policy Plan is the MPO's long-term transportation plan and is equivalent to the RTP. Published every five years, the Transportation Policy Plan incorporates transportation policies and plans that directly support its Regional Blueprint guide. The Transportation Policy Plan is a policy-driven document providing implementing agencies with strategies and guiding criteria to apply when considering transportation investments for the TIP. The plan fulfills the ISTEA and TEA-21 requirements for listing of major long-term transportation projects for which funding has been allocated, but unlike the Bay Area RTP, the plan deals less with strategies for specific corridors in the region, and more with general policies and guidelines for the region as a whole. A review of the current Transportation Policy Plan adopted in January of 2001 finds limited incorporation of economic development concerns within the RTP as summarized below:

- The main strategy of the RTP is centered on smart growth – a pro-growth approach to guiding development into patterns that are more compact and into areas where infrastructure allows growth to be sustained over the long term. The strategy as it relates to development is focused primarily on land-use issues rather than more broad economic development issues as they relate to the region’s business clusters.
- A short portion of the plan is subheaded “Strengthening Economic Competitiveness.” However, the brief policies listed under this subheading focus on strengthening “the region’s economic competitiveness by maintaining mobility for commuter travel and goods movement as the area grows and supporting a more compact urban form [140].” Again, the policy appears to be built more around land-use development, rather than specifically economic development (although the two are related).
- The RTP is based around five explicitly stated planning goals, one of which is “to advance economic competitiveness [141].” However, of the seventeen policies developed to guide the transportation planning process in support of these five goals, only one policy directly addresses competitiveness and economic development: Policy 12 – To Maintain a Competitive Regional Freight Transportation System. The policy calls on MnDOT to more effectively increase freight movements within the state transportation corridors and supports MnDOT in its attempts to have the U.S. DOT designate I-94 as a “Corridor of National Significance” given its connections to the Canadian border and role as a major corridor for international trade. The policy also calls for the preparation of a regional freight flows study to determine infrastructure needs for improved access to freight terminals. Of the remaining sixteen guiding policies, economic development is only indirectly addressed through land-use coordination with transportation projects.
- The Transit System Plan component of the RTP calls for the need to double the capacity of the bus system and develop a network of dedicated corridors to ensure the region’s economic vitality. The benefit of this policy is measured in congestion cost savings rather than economic development impacts. Within the Metropolitan Highway Plan component of the RTP, there is no direct mention of economic development initiatives or benefits from the recommended policies.

The short-range TIP process is initiated when the Metropolitan Council formally requests MnDOT and the RTB to submit a list of short-range transportation projects. The Metropolitan

Council summarizes the projects and forwards the list to the TAB for review and adoption, and finally returned to the Metropolitan Council for final approval. The Metropolitan Council maintains that projects are only included in the TIP if they (1) support the Regional Blueprint and RTP, and (2) maintain the region's economic vitality and quality of life. It is unclear from a review of the available TIP plans how the projects are actually prioritized by considering regional economic vitality.

Regional Airport Study

In 1996, the State Legislature passed a resolution directing the region not to build a new airport in the suburbs, but instead, focus on expanding the current airport, located only a few miles from the central business district of the region, within its space constraints. The Metropolitan Airports Commission, concerned about the constrained expansion capability of the Minneapolis International Airport (MSP) commissioned a study by the Center for Transportation Studies at the University of Minnesota to assess the competitive position of the region in the global economy via the air transportation infrastructure. The authors focused on the region's export-producing industry clusters and impact of the airport on their logistics. The conclusions of the study were similar to the Bay Area airport study in that MSP was not considered critical to competitive positioning achieved through efficient air cargo handling out of and into the Twin Cities region. The study found that other cities were better situated to handle the cargo, particularly Chicago O'Hare (ORD). In support of this assertion, the study pointed to the fact that Northwest Airlines, with its hub at MSP, does not cycle its 747 freighters through MSP, but rather they are deployed out of O'Hare, Kennedy, San Francisco, and Los Angeles. It is more economical for freight carriers to ship cargo by truck from MSP to ORD overnight and consolidate with other shipments rather than flying the same cargo directly out of MSP [142]. The study did not focus on the competitive impacts of providing high-frequency airline hub service over a global network for knowledge-intensive regional industry clusters.

5.2.3 Regional Summary

The Twin Cities region has only one working cluster, the Medical Devices cluster, which has earned the area the moniker "Medical Alley." The remaining clusters cited are likely only in the "potential" development stage. Only the initial cluster study in 1995 cited cluster-specific transportation infrastructure as important: (1) the MSP airport for supporting the competitive advantage of the Medical Device cluster, and (2) investment in public transit for providing access to workers for the labor-intensive financial services cluster. The fact that the MPO, with

responsibility for regional transportation planning, led the cluster study may have impacted the weight placed on transportation infrastructure. The six studies surveyed did not cite investment in transportation infrastructure as critical either for cluster-specific or general competitive advantage development. Competitive advantage in the region was not seen tied to the Twin Cities transportation infrastructure, although the region's geographic position in the center of the United States was cited several times as a competitive advantage. It is important to note that this advantage can only be taken leveraged through a well-functioning inter-regional transportation system. Finally, the RTP did not reflect cluster-based economic development within its framework; instead, economic concerns were mostly centered on smart growth land-use policies.

5.3 Tucson, Arizona

5.3.1 Regional Economic Development and Clusters

The State of Arizona is actively using the industry cluster framework to structure its state economic development initiatives and is nationally recognized as a pioneer in the implementation of a cluster-based economic development policy. State agencies work directly with the industry clusters rather than with individual firms. The State goes to extremes not to display favoritism towards specific industries within the clusters, but will coordinate efforts to bring together government, education, and other support groups to form a working cluster initiative for any emerging cluster that can organize itself and show its value to the state economy. Although specific firms are not targeted, the state does target specific clusters.

The Arizona cluster initiatives had their origins in the late-1980s when the state's real estate market collapsed after several decades of steady growth, sparking a severe recession. In reaction, a consortium of public and private leaders formed a task force through a public-private partnership, the Enterprise Network, which undertook the design of a statewide strategic planning effort. In 1989, the Arizona Legislature enabled the Economic Development Act which directed the State Department of Commerce to draft the first statewide strategic economic development plan. In 1990, the Enterprise Network brought together the Department of Commerce, the Arizona Economic Council, the Greater Phoenix Economic Council, and the Greater Tucson Economic Council in an effort known as the Arizona Strategic Planning for Economic Development, or ASPED. The first phase of the ASPED project was an assessment of the state's economic strengths and weaknesses, resulting in a strategic framework used to identify the state's clusters. The second phase of the project was the implementation of the strategic plan through a

process now referred to as the Governor's Strategic Partnership for Economic Development, or GSPED. The basis of GSPED is "a cluster-based economic development strategy, involving targeted marketing to attract and sustain industries that create quality, high-paying jobs and benefit the economy [143]." GSPED does not draw a direct link between transportation infrastructure and its cluster-based strategy. Indirectly, GSPED consider that "physical infrastructure and fundamental public facilities such as roads and mass-transit, airports and railways, water and sewage systems, and power and phone lines, transform raw land into a quality place to live and do business. [144]"

The Greater Tucson area embarked on its own regional cluster strategy at the request of the city of Tucson and Pima County. A data assessment of the Tucson regional economy was performed and a survey of business leaders identified the leading economic development strategies in the area. A strategic plan emerged from these efforts which encourage recruitment, retention, and expansion of specific clusters of industries in the area, and overall community development. The strategic plan also places a high degree of importance on collaborating with the statewide cluster-based strategy.

Tucson Clusters

The region has historically recognized five industry clusters, only one of which is mature and established, with the rest still in the emerging, or "potential," stage. Tucson's clusters are listed as follows:

Aerospace and Defense Industry Cluster: Anchored by the Raytheon Company and consisting of defense and space related manufacturing as well as firms which maintain and rehabilitate commercial airline fleets.

Bioindustry Cluster: Cluster consists of businesses that create and provide products and services characterized by life science activities. The cluster is in the emerging state and focusing on enhancing its relationship with the University of Arizona Medical Center.

Environmental Technology Industry Cluster: A fast-growing cluster represented by its own regional trade group, ETIC – Environmental Technology Industry Cluster. The cluster encompasses firms that provide products and services that monitor and treat pollution, or conserve and restore natural industries.

Information Technology: The cluster is in its initial developing state and is being promoted by a non-profit professional trade organization, ITASA – Information Technology Association of Southern Arizona.

Optics Cluster: A mature and established cluster which has earned the Tucson region the nickname “Optics Valley.” The University of Arizona Optical Sciences Center produces more graduates in optical science than any other institution in the nation. The cluster is represented by the non-profit organization AOIA – the Arizona Optics Industry Association – and consists of 115 companies [145].

Tucson Economic Development Organizations and Initiatives

The most prominent economic development organization in the Tucson region is GTEC – the Greater Tucson Economic Council. GTEC is a private, non-profit corporation created in 1994, and funded by the city of Tucson, Pima County, and regional towns of Marana and Oro Valley. GTEC leads the state of Arizona in administration and execution of the GSPED cluster concept, development, and implementation. While the organization’s efforts are centered around providing tax relief and job training resources for industry clusters, it does recognize the importance of transportation infrastructure for meeting the needs of its developing clusters. In its literature promoting the region’s attractiveness to cluster-specific firms considering relocating or starting-up operations to the area, it highlights several advantages of the region’s transportation network [146]:

- Ease of access to the global market place and strategic position along the Canada-Mexico trade corridor
- An expanding airport located seven miles from downtown which includes 9 daily non-stop flights to Mexico, serving Hermosillo and Guayamas in the State of Sonora
- Two interstate highways intersect in the Tucson area: (1) Interstate 10, a cross-continental highway connecting Tucson with Phoenix and Los Angeles to the northwest, and El Paso and Dallas to the east, and (2) I-19 connecting Tucson with Nogales, Mexico 63 miles to the south

Figure 5-7: Proposed CanaMex Corridor



Many of the organization's efforts are focused on the link between Tucson and Mexico. GTEC's regional economic development plan was specifically created to promote efforts to more fully integrate Southwest Arizona and the Mexican State of Sonora as a single competitive region.

Another economic development program administered by the City of Tucson is called the Tucson Maquila Supplier Program (TMSP). The Mexican Maquiladora Industry is known as the "twin plant" industry and consists of foreign-owned in-bond manufacturing plants located across the border in Mexico which prior to NAFTA had enjoyed special tariff benefits. Mexican Maquiladora plants perform a portion of the manufacturing process for U.S. companies, mainly component assembly. Most Maquiladora assembled components are returned to the U.S. for final processing and

distribution. Even with the increased logistics of shipping components twice across the U.S. – Mexico border, the cost of the finished product is reduced due to lower labor expenses, making it more competitive in world markets. TMSP helps regional cluster industries identify suppliers in Mexico who can reliably produce high quality goods at competitive costs. TMSP also promotes the ability for clusters to maintain key components of their operation in Tucson, such as R&D functions, final assembly facilities, and warehouse and distribution, while locating manufacturing functions in Mexico.

The Tucson-Mexico Project is a public-private partnership sponsored by the City of Tucson to assist businesses and organizations improve their connections with Mexico. Mexico is Arizona's leading export destination, with Canada the second largest. The focus of the program is the lobbying of improvements to the CanaMex Corridor, shown in Figure 5-7. Officially designated by Congress in 1994, the CanaMex Corridor plan is to provide a continuous 1,700 mile highway system link from Alberta, Canada to Mexico through the Rocky Mountains, southwestern states, and Tucson. The Tucson-Mexico Projects participates in the Western CanaMex Coalition, formed in 1997, to provide strategic planning and enhancement of this trade corridor. The Tucson-Mexico Project is also involved in collaboration with the Tucson Airport Authority on the Puerto Nuevo project. The goal of the project is to develop a multidimensional distribution center – an “inland port” – incorporating a truck hub, a bypass from I-19 to I-10 allowing for an efficient link to the CanaMex Corridor, a rail-truck transfer program, and enhanced air cargo facility all centered at or near the Tucson International Airport property.

The need to invest in improved regional transportation infrastructure is gaining increased attention. In 2000, one of Tucson's largest companies, Alpha Graphics a printing and publishing company, decided to move its headquarters to Salt Lake City. The CEO of Alpha Graphics cited the Salt Lake City's air transportation access as an important relocation decision variable [147]. In 2001, a report released by the University of Arizona's Office of Economic Development showed that although the trade value of exports between Arizona and Mexico had climbed 65% between 1995 and 1999, the Arizona's share of overall U.S. – Mexico trade declined from 5.5% to 3.9% in the same period. Because the two states have had better, and longer, transborder relations than other southwestern states giving a competitive advantage over other U.S. regions, the report analyzed other potential factors which could cause the decline in overall trade share. The study associated some of the decline with Tucson's inadequate air, rail, and highway links given long distances between the city and Mexico's industrial centers [148].

5.3.2 Regional Transportation Planning

In 1970, the Pima Association of Governments (PAG) was designated the MPO for the Tucson Metropolitan Area. The regional council is composed of one elected official from each Tucson municipality and a representative from the Arizona State Transportation Board governs the PAG. In 1988, PAG formed a citizen's committee to act as a review body for the development of its long-range transportation plan, the TIP, and the Regional Aviation Systems Plan.

The current RTP was adopted in 2001 and is built around four overarching policies: (1) mobility and accessibility, (2) environment and community, (3) financial feasibility, and (4) public support. Economic development is not explicitly mentioned as a desired outcome of the plan. Under the second policy, environment and community, the plan describes its goal to “assure that transportation investments provide a beneficial impact on the region’s economic vitality [149].” The RTP states that the economic impacts of transportation decisions are typically considered during project evaluation. The economic impact analysis of projects includes an assessment of the project costs and economic benefits to the transportation system users, and the assessment of the cost-effectiveness of individual transportation projects. Although the economic impact analysis provides no measure of the economic development impacts as defined within the context of this research, PAG commits as part of its future initiatives broadening the scope of analysis of economic impacts in subsequent RTPs.

Only one of the initiatives promoted by the Tucson economic development organizations was recognized in the 2001 RTP: the I-19 to I-10 Bypass, an improvement to the CanaMex Corridor. This project was included under the funded projects as an initiative to be further studied for potential inclusion in the 2004 update.

5.3.3 Regional Summary

The Tucson region has undertaken a nationally recognized cluster-development initiative in support of its one “working” cluster – Optics – and its four other “potential” clusters. The regional initiative is part of a broader state-wide cluster-development policy. Regional economic development organizations recognize the general role transportation infrastructure plays for its clusters, but do not promote cluster-specific infrastructure needs. Most of the focus is devoted to improving transborder linkages with Canada and Mexico. Despite the well-publicized and organized cluster initiative, cluster-based economic development is not specifically mentioned in the RTP. Furthermore, only one of the transportation-related initiatives promoted by the local economic development organizations was recognized by the plan, and only as the subject of a proposed study, rather than actual infrastructure investment.

5.4 The Transportation Cornerstone Project, Florida

Project Background

While technically a statewide initiative, rather than a regional strategic plan, the Florida Transportation Cornerstone Project conducted in 1999 warrants a brief mention as it is the best example to date of a systematic attempt to assess specific transportation infrastructure needs of industry clusters. While the identification of the three state industry clusters evaluated was based on a rather qualitative approach, the project provides a useful framework to approach the evaluation of industry cluster transportation needs.

The ambitious goal of the project was to assess linkages between transportation infrastructure, business logistics, and economic competitiveness in Florida's key industry clusters; and to define the critical factors necessary of a statewide transportation infrastructure investment strategy. The project methodology included personal interviews with business professionals at more than 30 businesses within the three chosen industry clusters: trade and distribution clusters, high-technology clusters, and the tourism cluster. The cluster-by-cluster analysis used the following framework: (1) analyze and evaluate the economic and logistic trends impacting the cluster; (2) identify the specific transportation requirements critical to the competitive advantage sought by the cluster; (3) characterize and categorize the current transportation deficiencies experienced by the industry cluster; and (4) present several case studies per industry cluster illustrating the relative importance of the transportation network on its competitive situation and the impact of any transportation infrastructure deficiencies. Based on the assessment, the project made the following interesting recommendations:

- Establish a "Trade and Economic Corridors" program for coordinated planning, design, and construction of corridors of statewide significance to promote economic development and international or inter-regional trade
- Clearly and consistently link transportation planning with economic development activities at the state and local levels by (1) adding explicit economic development goals in to state and metropolitan long-range transportation plans; and (2) the State DOT and regional MPOs should include economic development impacts as part of their criteria for setting priorities among projects
- Increase business involvement in transportation planning activities

- Elevate the importance of freight mobility in state and metropolitan transportation planning
- Create a “fast-track” for projects with high economic impact

5.5 Case Studies’ Lessons Learned

Based on the prior discussion regarding the regional cluster studies and transportation planning efforts, the findings from the four case studies can be summarized as below in Table 5-3:

Region/State	Cluster Study Lead Organization	Cluster-Study Findings		MPO Involved in Cluster Study?	RTP/STP Cluster-Development Recognized in RTP or STP?
		Cluster-Specific Transportation Needs Identified?	General Transportation Needs Identified?		
SF Bay Area	Public-Private Partnered Economic Development Organizations		X	X	
Twin Cities	MPO	X	X	X	
Tucson	City of Tucson		X		X
Florida	Florida Chamber of Commerce	X	X		

Table 5-3: Summary of Case Study Findings

The review of the four case studies provides the following nine observations:

1. In general, the link between economic development and transportation planning is limited or absent in regional plans. MPO-developed Regional Transportation Plans offer general goals for economic-based considerations, but do not define measurable performance objectives, or recognize cluster-based economic development initiatives.
2. Silicon Valley, the Twin Cities, and Tucson each have nationally recognized examples of strong cluster-based development initiatives, reflecting five to fifteen years worth of policy. However, the transportation policy regarding economic development lags behind.
3. In Florida’s case, and most likely representative of other initiatives conducted at a statewide level, there is a disconnect in the geographic scope of the planning: identified clusters operate on a regional, national, and international scale, while transportation planning occurs at a decentralized level driven by individual MPOs.

4. The Bay Area's cluster-based economic development organizations play a very active role in assessing the region's transportation network, and are institutionally linked to the MPO, yet the RTP does not reflect the economic development organizations' stated transportation priorities.
5. Cluster-specific transportation needs are rarely identified. Common to all cluster studies was the identification of more general transportation needs applicable across all clusters.
6. A MPO-led cluster study does not guarantee that the MPO's RTP will be tied to cluster-based development as was demonstrated in the Twin Cities case.
7. In the cluster studies, transportation needs focused on the complete trip, crossing multiple modes; while the RTPs tended to focus on modal-specific corridors.
8. Project prioritization for inclusion in regional transportation plans generally reflect "home-to-work" travel issues such as travel time, delays, safety, and mobility; rather than "goods-to-market" issues such as freight mobility and economic development.
9. Gaps in the scale of planning timeframes prevent immediate cluster needs from being addressed in the timely manner needed to gain or maintain competitive advantage. Industry clusters and economic development agencies often conceive of long-term planning as a three to five year cycle. Long-term transportation planning operates on a three year cycle but with a twenty-year planning horizon. Short-term transportation planning occurs annually, but uses the twenty-year plan as the guiding document.

This chapter has reviewed four regions within the United States, assessing their cluster-based economic development policies and their linkages to the regional transportation plans. Having now introduced the theoretical background to regional competitive advantage as well as examples of its practical application, the next chapter turns to extending the ReS/SITE framework in order to consider strategic transportation planning within the regional competitive advantage context.

Chapter 6. Extending the ReS/SITE Framework

The Regional Strategies for Sustainable Intermodal Transportation Enterprise (ReS/SITE) program at MIT identified eight broad shortcomings in conventional transportation planning. Research conducted by Muñoz (1998), Pendleton (1998), Conklin (1999), and Makler (2000) have considered many of these insufficiencies. Recently, in their assessment of the five-year program, Sussman and Conklin (2001) recommend that future work focus on expanding the ReS/SITE framework to incorporate regional economic development [150]. The goal of this chapter is to respond to the need to more adequately address economic development within transportation planning and assess the significance of transportation investment in developing and sustaining regional competitive advantage. The first task of this chapter is to describe a cluster initiative architecture, capturing the important economic development-related institutions and related strategic plans. The second task is to develop a cluster needs assessment framework which can assist planning organizations in their evaluation and prioritization of transportation infrastructure investment with respect to regional competitive advantage. The third task of the chapter is to make the adjustments to Makler's Comprehensive Regional Architecture, described in Chapter 4, needed to incorporate economic development initiatives in addition to service and planning activities. The final task is to re-evaluate the ReS/SITE planning framework, reflecting the revised Regional Architecture and integrating the important elements for developing and sustaining a regional competitive advantage.

6.1 Economic Development, Competitive Advantage, and Clusters: Revisited

As regional transportation planning has evolved, the recognition of the importance of economic development considerations has grown, culminating with TEA-21's charge that transportation investment decisions support metropolitan economic vitality. However, a clear link between economic development and transportation planning remains limited or absent in most regional plans. Chapter 5 presented case studies which demonstrated that even in regions with innovative economic development planning, such as the San Francisco Bay Area, regional transportation plans offer only general economic development goals, without offering measurable objectives or active involvement from the business community.

This thesis has made the argument that economic development requires enhancing regional productivity. The result of economic development is a change in the structure of the regional economy reflected in innovations within its institutions' and firms behavior and technology. A region is said to gain a competitive advantage if it is able to sustain a growth in productivity. Regions able to gain competitive advantage exhibit an environment which promotes geographically-concentrated clusters of competitive industries. To address economic development within transportation planning, it follows that it be beneficial to consider transportation services and planning in the context of clusters. The next section will develop the regional architecture representation of an economic development cluster initiative, illustrating the important institutional and policy relationships to transportation planning.

6.2 Defining the Cluster Initiative Architecture

The Cluster Initiative framework was presented in 2.5.3 as a four step process. Figure 6-1 transforms the process, focusing on both the institutions and output important to a typical cluster.

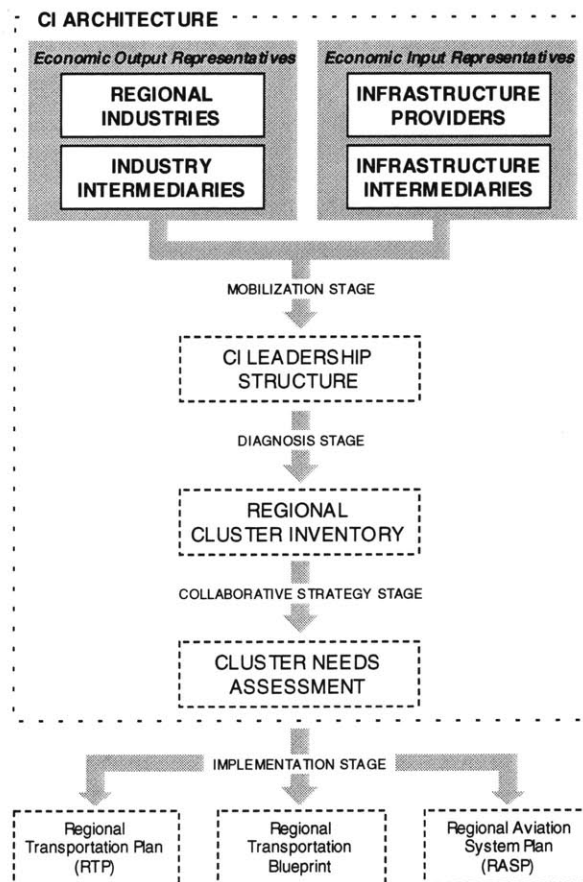


Figure 6-1: The Cluster Initiative Architecture

Economic Institution Representatives

The critical first step of any analysis of a region's clusters is the assembly of all key stakeholders relevant to the economic development effort to be undertaken. Figure 2-8 gave a complete list of the stakeholders, but from the transportation planning perspective, it is essential that the regional MPO and transportation service and infrastructure providers participate in the early stages of the cluster effort. Communication and institutional linkages will be established with the economic development organizations in these initial stages. The MPO and other transportation institutions may eventually find themselves in several roles throughout the process.

The organizations may participate in an *informational* role, providing data on transportation trends as well as information and data specific to transportation projects within its existing regional transportation plans. A *specialist* role may be played if the transportation organizations provide expertise and specialized analysis to one or more of the economic input or output representatives. For example, MnDOT has a staff of five specialists, each dedicated to one of the five primary clusters which were identified for the Twin Cities. Efforts by the specialists include reviewing regulations and proposed projects which specifically impact an industry, keeping industries informed about regional and state transportation policies and programs, and focusing on specific infrastructure requirements by particular industries. The transportation organization might serve in a *broker* role, helping match industries with freight solutions to meet their needs through an MPO Freight Advisory Council or Airport Commission; or by promoting local policies which address job accessibility through specialized transportation solutions. Non-transportation organizations will also fill the specialist, informational, and broker roles, as well as the additional roles of organizer or networker. An institution acting in the *organizer* role could take responsibility for incubating an industry cluster until it reaches a critical mass at which time the organization leaves it to the cluster firms to further organize themselves. Universities often play this role whether intentionally planned or not, such as Stanford University in the early development of Silicon Valley, and the University of Arizona with the optics cluster in Tucson. Transportation organizations typically do not have the ability to fulfill this role, except perhaps if the industry cluster is specifically transportation, such as a freight and logistics cluster consisting of specialized port facilities and intermodal infrastructure or services. The *networker* role assists industries through organizing industry associations or informal networking through referral lists, a role that is again unlikely to be played by a transportation planning organization unless it has specific economic development responsibilities.

Cluster Initiative Leadership Structure

Once the economic input and output institutions have been mobilized, the first plan to emerge is the cluster initiative leadership structure. Most initiatives fail early in the process because efforts are led by economic input intermediaries only, and while these organizations may have the ability to sponsor or communicate cluster initiative efforts, they do not have the capacity or authority to implement the actual work of the cluster development process. Though MPOs play a central role in transportation planning efforts, they are not in a position to lead the cluster initiative, recalling that only 33% of MPOs cited have economic development responsibilities. The leadership configurations which emerge from the mobilization plan should fall under similar organizational structures as described by Conklin (1999).

The *integrated* leadership structure consists of an existing organization which has responsibility for all aspects of leading and implementing the cluster initiative. Cluster identification, assessment, and implementation are governed from within a single organization, without the need to create new departments within the organization. In the United States, no organization currently exists which could fulfill this requirement as there are no observable examples of institutions with fully-independent regional governance and overarching regional authority. The *semi-integrated* structure is similar to integrated structure, except the responsibilities for economic development and cluster initiatives may be handled by new departments created for some aspects of the effort while other functions are shared by existing services. A metropolitan-wide planning organization with responsibilities for both economic and other development aspects may be in a position to create an internal group dedicated to the cluster initiative with assessment and implementation functions shared by existing internal departments. An *umbrella* structure may be constructed such that a new regional organization is created to oversee and coordinate the cluster initiative among the economic representatives at the regional level. This structure may lack the authority found in the integrated or semi-integrated structures, but is a more realistic solution for most regions. The final leadership structure to emerge is the *distinct* structure, in which no new organization is created to oversee the effort, while the initiative is coordinated loosely by existing economic input or output representatives, most likely one of the intermediaries. Many current leadership efforts fall under this last category, and as was cited in Table 4-4, are often ineffective as it is found that 50% of all regional economic development efforts have either ad-hoc or no coordination. We expect institutional linkages, important in regional architectures, will evolve within the boundaries established in the initiative leadership structure.

Regional Cluster Inventory

The outcome of the diagnosis process of a cluster initiative is a detailed inventory of the region's emerging and established clusters. The process of cluster identification was described in Chapter 2; however the typical inventory created is composed of clusters simply identified by high-level aggregated SIC classifications. The only meaningful way in which to address specific transportation needs for an industry cluster is through an inventory which identifies clusters in a more definitive and specialized manner. At the aggregate SIC classification, it is fair to say that almost any cluster will have general needs for freight and passenger transportation infrastructure. This generalized observation provides almost no meaningful information from which a transportation planning organization can assess and prioritize specific transportation plans and services from a regional competitive advantage perspective. Drawn from the survey of cluster literature and the four cases studies addressed in Chapter 5, Table 6-1 compiles eleven commonly identified SIC aggregate clusters. Also included in the table are cluster types that go one step further than the SIC code in providing a more specific evaluation context for transportation investment.

Typical Aggregate Description	More Precise Cluster Type Examples
High-Tech	Business/Financial Software, Networking Hardware, E-Commerce
Multimedia	Publishing, Motion Picture Industry, or Advertising
Telecommunications	Telemarketing or Inbound Reservations Call Centers
Banking and Financial Services	Mutual Funds, Insurance, Venture Capital, Credit Card Processing
Business Services	Hospital Management or Real Estate Development
Biosciences	Biotechnology, Environmental Technology, Medical Devices
Optics	X-ray/Laser Devices, Diodes
Manufacturing	Computer Assembly, Furniture, Jewelry, Marine Equipment, Automobile, Consumer Appliances, or Consumer Electronics
Tourism	Outdoor Recreation, Amusement Parks, or Casinos
Aerospace/Defense	Aircraft Design/Assembly, Space, Military Base
Agriculture	Wineries, Livestock

Table 6-1: Aggregate Versus More Precise Cluster Types

The basic argument is that the more precise the cluster identification, the more *specialized* the transportation infrastructure can be in order to support the cluster firms. Additionally, many

initiatives create an inventory with so many clusters that the initiative will suffer from a lack of focus on those clusters actually critical to the region's competitive advantage. It is important to note that all four case studies presented in Chapter 5 defined their regional clusters at the highly aggregated level similar to what was presented in Table 6-1.

Cluster Needs Assessment

For transportation planning, the most important outcome of the collaborative strategy phase is a detailed needs assessment for the regional clusters, containing both specialized requirements for individual clusters and cross-cutting initiatives which address shared needs across the region. In seeking to incorporate regional competitive advantage into the planning process, transportation organizations should focus principally on the needs identified in the assessment. Infrastructure and service investment can be prioritized and ranked according to the degree to which they fulfill the competitive needs of the critical regional clusters. Regional transportation strategic options can be evaluated by the multicriteria analysis proposed by Muñoz (1998) and Conklin (1999), assessing the degree to which different strategies address feasibility, effectiveness, and competitive advantage criteria. Focusing on the specific cluster needs provides transportation planners the opportunity to move from using generic economic development goals to specific performance measures related to the degree to which transportation investment is impacting a region's competitive advantage. Section 6.3 proposes a high-level theoretical framework with the potential to assist transportation planning organizations both assess the transportation needs of a given inventory of clusters, and evaluate the degree to which a transportation strategy meets the competitive needs of the region.

Implementation Plans

Once the needs have been assessed and a region-wide economic development strategy developed, the implementation of the initiative requires that the cluster needs be integrated within the regional transportation planning process. Three routinely prepared transportation plans are of most relevance for this endeavor: the Regional Transportation Plan (RTP), the Regional Transportation Blueprint (RTB), and the Regional Aviation System Plan (RASP). The RTP captures funded regional transportation projects over a long-term planning horizon. Under ISTEA, the RTP was required to exclude any project that was not fully funded. Because the RTP and cluster initiative processes occur over different planning cycles and time horizons, it is important the cluster-related transportation investments be captured elsewhere within the planning architecture. In this case, a RTB is used by some regions to capture major transportation projects and programs championed by regional stakeholders but not included in the budget-

constrained RTP. The RTB weaves into a single blueprint funded and unfunded projects, allowing for a strategic approach to transportation planning to be maintained despite fiscal uncertainty. A new initiative under TEA-21 known as “Illustrative Projects” permits the inclusion of certain unfunded transportation projects into the otherwise financially constrained RTP. The list of illustrative projects within the RTP is composed of projects which represent placeholders for priority future investment if additional resources beyond those identified in the RTP financial plan become available [151]. With this TEA-21 initiative, the RTP and RTB now overlap to a certain extent.

The final important plan to consider in the implementation stage is the RASP. Within clusters, factors such as face-to-face communication, economic linkages, and JIT play significant roles in sustaining competitive advantage. Airports often provide important passenger and freight transportation infrastructure in support of these factors. Under ISTEA and TEA-21, only airport access was required to be addressed as part of the transportation plans required at the regional level. The RASP planning document provides a broader scope of regional aviation issues beyond simply airport access, including concerns such as capacity, delay, integration of regional airports within a single system, and air cargo concerns. While not critical in all cluster development initiatives, airport issues often play an important role in the competitive advantage of certain regional clusters. These specific needs must be incorporated within any planning process striving to fully incorporate economic development objectives.

Transportation investment projects addressing regional cluster needs will likely be represented to some degree in each of the three plans mentioned above, as no single plan provides complete modal and project coverage. Figure 6-2 illustrates the relationships between the ISTEA family of plans and economic development related transportation plans.

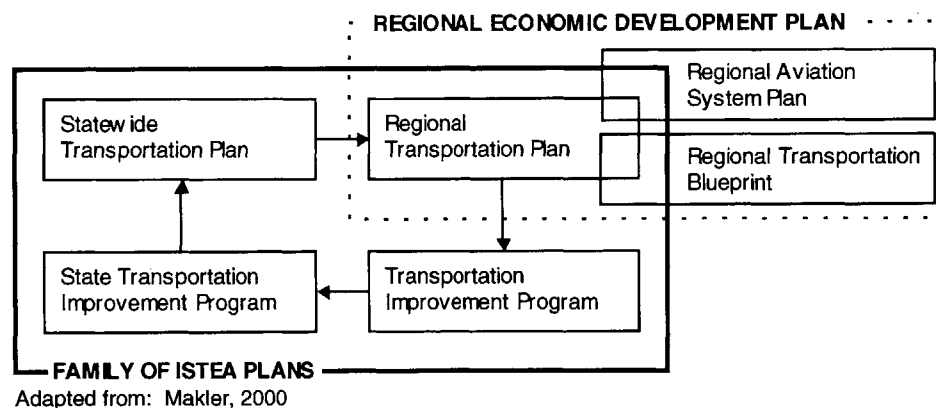


Figure 6-2: Relationship Among Transportation Plans Relevant for Economic Development

To summarize Figure 6-2, the long-term STP guides each RTP, while the TIP carries out the short-term objectives of the RTP. The STIP represent a compilation of each regional TIP, analogously implementing the goals of the STP, creating the transportation planning cycle [152]. The RASP and RTP overlap through TEA-21's illustrative project category, while the RTB and RTP share airport access agendas.

6.3 Cluster-Specific Transportation Needs Assessment Framework

Porter makes it clear that for a factor input, such as transportation infrastructure, to contribute to sustaining competitive advantage, it should be tailored to the cluster's needs. Additionally, different clusters, even in the same region, may have very different characteristics and therefore different transportation needs. It is clear that a single-solution, or "one-size fits all" approach to incorporating competitive advantage within strategic transportation planning will not be sufficient. Figure 6-3, on the following page, introduces a systematic approach by which a transportation planning organization can assess the specialized needs of an individual cluster, and the framework is drawn from a synthesis of the material presented in the first four chapters of the thesis, though is expected to be applied more specifically within the transportation context.

Step 1: Identify the Precise Cluster Type

The case was made in Section 6.2 that a precise cluster type must be the starting point for any informed cluster discussion. For a cluster as broad as, for example, "Banking and Financial Services," it would be difficult, if not impossible to investigate or implement specialized transportation infrastructure solutions for such a generalized description. Similarly, if the Banking and Financial Services cluster is broken into multiple sub-clusters such as Mutual Funds, Insurance, and Venture Capital, a general solution applied to all three sub-clusters still may not provide for the targeted improvements required to sustain competitive advantage. For example, a venture capital cluster will likely rely more heavily on face-to-face communications versus a more data-intensive insurance cluster which may rely more on telecommunications infrastructure. The more precisely a cluster can be identified, the more specialized the transportation infrastructure or service investment. The more specialized the transportation infrastructure and services, the more scarce a resource they represent, and in turn, the more difficult for competing regions to replicate.

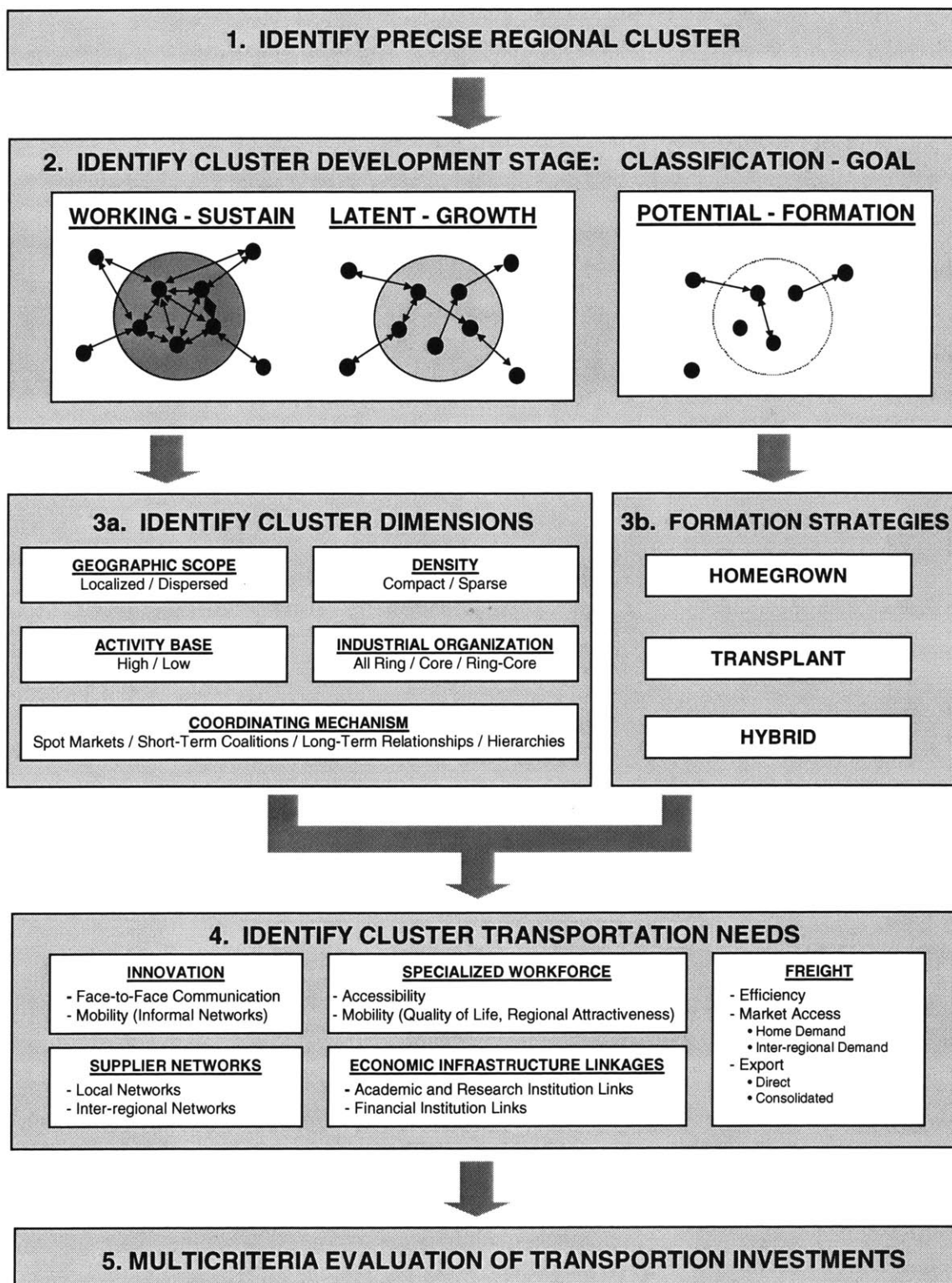


Figure 6-3: Cluster-Specific Transportation Needs Assessment Framework

Step 2: Identify Cluster Development Stage

Once a precise cluster has been identified and targeted, knowledge of the state of development for a particular cluster is extremely useful in determining where to focus on the details of competitive advantage improvements. The state of development does not refer to the age of the cluster, but the strength of the dynamics occurring between cluster components and the degree to which they are self-reinforcing. For working clusters, strategic transportation planning emphasis should be placed on sustaining the competitive advantages currently being enjoyed. Strategies may need to focus outward on improving penetration of export markets, or inward on preventing constraints on future productivity growth such as localized congestion or accessibility to a skilled labor markets. For latent clusters, strategic transportation planning emphasis should be placed on growing the internal dynamics of the cluster so that it reaches the working stage. Strategies may need to focus on improving linkages between the economic infrastructure of the cluster, for example, the network between cluster suppliers and export producers, or providing infrastructure and services which facilitate face-to-face communication necessary for competitive or cooperative innovation. For potential clusters, focus shifts to strategic options which can stimulate the formation of a latent, and eventually a working cluster. General efforts may be focused on more the traditional external economies in which reduced transportation costs assist in encouraging geographic concentration of interrelated industries. Specific efforts will depend on the formation strategy chosen in the cluster initiative, as described in Step 3b.

The most important distinction is between the working/latent clusters classification and the potential cluster classification. This distinction determines whether the strategic transportation plan will focus on specialized investments or general strategies to provide the opportunity for a cluster to develop over time. In other words, the intensity with which transportation planning organizations incorporate competitive advantage within their strategic plans will depend on the stage of the regional clusters. A working cluster is currently providing a region with a competitive advantage and the corresponding economic development benefits. Priority should be given to sustaining the working cluster over any other cluster type. Because of the dynamic nature of cluster growth, there are no guarantees latent clusters will ultimately progress to a fully working cluster. Accordingly, efforts directed at latent clusters should usually be given lower priority than working cluster initiatives. Decision-makers may chose to disregard potential clusters altogether, especially in light of the resource-constrained transportation planning environment. A region without any working or latent clusters may choose to dedicate its economic development efforts toward encouraging pre-selected industries to develop or relocate

to the region, otherwise, specialized investment considerations for potential clusters are a low priority, relying instead on market forces to foster geographic agglomeration of related industries.

Step 3a: Identify Cluster Dimensions

For a working or latent cluster, the next step is to characterize the cluster into relevant dimensions or defining characteristics. The dimensions of a cluster provide a deeper understanding of the cluster and offer the opportunity for framing the decision-making as to the most appropriate types of transportation investment, further assisting in the development of specialized strategies. The important dimensions within the transportation context are described below.

Geographic Scope refers to the extent to which the cluster firms, suppliers, skilled workforce, and economic infrastructure are distributed within the region. Localized clusters are tight groupings in a small geographic area, perhaps in a municipality. Focusing on only a segment of an overall travel corridor might be more appropriate in the transportation planning context. Alternately, dispersed clusters are widely spread across the region, and may call for transportation corridor or system-wide transportation network investments.

Density refers to the quantity and economic size of the cluster. A sparse cluster may be composed of a relatively few number firms or firms which overall contribute a proportionally small share of economic wealth to the region. An intensely dense cluster may be populated with hundreds of firms with economic impact, measured in total annual sales, reaching in the hundreds of millions of dollars or more. The fewer the firms, the greater the likelihood that the required transportation investment will occur on a smaller scale.

High-Activity clusters exist when many of the critical activities of the clusters are performed locally, including research and development, financing, manufacturing, and marketing. *Low-Activity* clusters involve only one or a few critical activities for a given cluster located within the region, the remaining activities either being dispersed or outsourced to other regions. The degree of activity will determine the relative importance of specialized inter-regional transportation links versus intra-regional transportation links for low- and high-activity clusters respectively.

Industrial Organization refers to the organizational structure among firms in the cluster, with the idea of (1) a core implying that some firms have the ability to influence the existence of other firms within the cluster, and (2) a ring implies that the existence of any given firm is not strictly

determined by decisions made by another firm. An example of an “all-ring” cluster is the Silicon Valley semiconductor industry in which there was no systematic lead firm within the cluster, and no established hierarchy of power. An “all-core” cluster represents a vertically integrated firm in which the “suppliers” and much of the economic infrastructure is self-contained within a single organization, though not necessarily within a geographically centralized area. This structure, in pure form, is exceedingly rare. A third option is a “core-ring” combination in which one firm (the core) is the leader and has dominant influence over the suppliers and subcontractors (the ring), with the ability to unilaterally reshape the nature of the ring. The aircraft manufacturing cluster in Seattle, dominated by Boeing, exhibits this type of industrial organization. The implication for strategic transportation planning is the type of public-private institutional partnerships established during the economic development initiative. An all-core or core-ring cluster may see a single lead firm partnering with the transportation planning and service organizations in the strategic planning process. Transportation strategies have the potential to be more specialized as location and other decisions by the core firm can be coordinated with the transportation investments. On the other hand, an all-ring cluster may necessitate that a partnership be made with a trade association or chamber of commerce rather than specific firms.

Coordinating Mechanism refers to the way in which inter-firm relationships are managed within the cluster. A cluster with relationships occurring in a very fluid nature either from one-time or short-term coalitions will benefit less from specialized transportation investment and instead profit from more general investments which improve overall accessibility. Clusters which rely on well-established hierarchies or long-term relationships within the region can gain more benefit from specialized fixed infrastructure with less risk that a less flexible investment will be underutilized in the future.

Step 3b: Formation Strategies

There are several strategies a region can undertake to develop potential clusters. The transportation infrastructure investments should be consistent with the development strategy. Knowledge of whether or not the industries are being actively recruited from outside the region, or if the removal of local regional constraints is in fact the policy, will influence the priority of different infrastructure investments.

Homegrown strategies, also known as organic strategies, focus on removing regional infrastructure and regulatory constraints which impede the ability of local firms to develop or improve informational flows and institutional interactions. Most of the efforts are focused on development based on firms already present in the region. The advantage to this strategy is that it is built upon unique features of the regional environment and can create distinct, difficult to replicate advantages. However, there must be a strong economic base on which to build. From the transportation planning perspective, efforts can be directed at improving the efficiency of existing infrastructure and services.

Transplant strategies attempt to build clusters by attracting outside firms or suppliers who may fit in particularly well with the regional economic environment. In turn, strategic transportation plans will focus on new specialized infrastructure, rather than existing infrastructure as in the homegrown strategy, serving instead as a means to provide an interconnected network attractive to expanding or relocating firms outside of the region. This strategy has the similar appearance to the 1970s economic development strategy of recruiting manufacturing industries to the region. While these attempts often degenerated into destructive bidding competitions between regions, the cluster perspective targets firms which would have integration potential within the region's existing network of suppliers, and focuses on value-added activities such as research and development and regional headquarters, rather than manufacturing alone.

Hybrid strategies are simply some combination of the homegrown and transplant approaches. The strategy involves initial efforts to attract outside industry investment before becoming more engaged in developing dynamics within the regional economic base. Improvements to the existing infrastructure as well as additional investment in new facilities might be required. The hybrid approach requires a well-defined and strong leadership structure within the cluster initiative as the strategy might result in confusion or competition between policies to attract outside firms and policies to develop local industry.

The first three steps of the needs assessment framework are contained within the cluster initiative process. Identification of the clusters, subsequent prioritization of targeted clusters, and characterization of cluster development stages and dimensions require the involvement of the cluster initiative stakeholders within the mobilization and diagnosis stages of the initiative. To evaluate and prioritize transportation strategic options with consideration for regional economic development goals, the transportation planning process will require this information, but does not

have the institutional capacity to unilaterally undertake such an endeavor. Consequently, the overarching relationship between regional economic development and regional transportation planning is established. The competitive advantage framework, as implemented through a cluster initiative, will result in list of targeted clusters from which the transportation planning process will assess transportation investments for sustaining competitive advantage and take responsibility for incorporating the identified investments within the region's transportation plans. The transportation planning process resides within the economic development process and can only address the significance of infrastructure and service investment within a competitive advantage context if the economic development process is underway and the processes are institutionally linked to each other.

Step 4: Identify Cluster Specific Transportation Needs

The type, stage, and classification of a cluster from the first three steps provide a means to segment and target the specialized transportation needs which will contribute specifically to growing or sustaining the cluster's competitive advantage. Consider the following two descriptions regarding a hypothetical regional cluster.

Description 1: A Biosciences cluster employing 4% of the regional workforce compared to a national employment share of 3%. The cluster contains 30 inter-related firms, one dedicated regional industry association, and is experiencing job growth of 3.5% annually.

Description 2: A Cardiovascular Medical Device working cluster characterized as localized, sparse, and low-activity, with an all-ring and long-term relationship structure.

The first description is simplified, but similar to those commonly found in a cluster identification study. Although the concentration and economic growth aspects of the cluster have been quantified, the description provides little meaningful information from which to begin the evaluation or prioritization of a transportation investment or strategic plan. The second description implies that a targeted rather than transportation corridor level investment may be in order due to its localized nature. The efficiency of interregional links such as airports or freight distribution centers could be investigated as the cluster has low internal activity, with many critical activities occurring outside the region. At the same time, the sparseness of the cluster might imply a smaller scale investment will be needed overall. The all-ring, long-term

relationship structure of the cluster industries further implies that a general cluster-wide, rather than firm specific, strategy could be in order.

Because of the large variety of cluster types, further differentiated by economic and environmental conditions unique to each region, cataloging specialized transportation needs by multiple cluster types is beyond the scope of this research. For the purposes of this high-level framework, the assumption is made that institutional linkages, or the economic development architecture, between transportation and other economic development representatives will have been established within a cluster initiative. Through these linkages, specialized transportation needs may either be directly communicated to the transportation planning organizations, or the cluster characterizations can be adequately communicated for analysis by transportation planning and service providers.

While specialized transportation requirements will vary by cluster type, stage, and dimension, Chapter 2 presented a relatively few broad categories of investment which have the ability to sustain or grow competitive advantage dynamics. The needs assessment framework presented in Figure 6-3 proposes five broad areas which capture the intersecting circumstances of potential cluster-competitive needs and the ability of transportation investment to impact. These five areas include: (1) enhancing the innovative capacity of the cluster; (2) providing the ability for improved efficiency and scale of supplier networks; (3) improving the accessibility to, or mobility of, a cluster's specialized workforce; (4) improving the linkages to other important economic infrastructure such as research and financial institutions; and (5) freight and shipping issues as related to transportation costs, access to home demand markets, and export markets. A more detailed description of each broad area can be found in Sections 2.6 and 3.6.

Step 5: Multicriteria Evaluation of Transportation Investments

Once specialized transportation investments have been identified for each cluster type, the evaluation of planning options can be made in two different contexts: (1) cluster-level evaluation of specific transportation investments as they relate to individual clusters; and (2) strategic evaluation of regional transportation plans incorporating multiple transportation investments and a region's overall inventory of clusters. The suggested evaluation procedure follows the spirit of the ReS/SITE methodology in that it employs a multicriteria analysis, as outlined by both Muñoz and Conklin.

The evaluation at the *cluster level* begins by determining the relative importance of the broad transportation needs as they relate to the cluster's competitive advantage. In the theoretical example presented in Table 6-2, a score (I) of 1 to 5 is assigned to each competitive advantage need, with a 1 indicating a low level of importance to the cluster. The measure of importance should be an outcome of the needs assessment step of the cluster initiative. Next, the performance (P_N) of a proposed transportation investment is scored on its ability to meet the specialized competitive advantage need. The investment's performance scores are summed across all transportation needs after first being multiplied by the importance factor, deriving an overall score and ranking of options. In the hypothetical example below, the rapid transit extension investment scored lowest in absolute score, but had the highest overall score due to its ability to best meet the cluster's most important transportation-related competitive need.

REGIONAL CLUSTER (RC_N)		Performance of Transportation Investment					
		Airport Capacity Expansion		Rapid Transit Extension		Highway Corridor Capacity Increase	
Competitive Advantage Transportation Needs	Importance to Cluster (I)	Performance (P_1)	Weighted Performance ($I \cdot P_1$)	Performance (P_2)	Weighted Performance ($I \cdot P_2$)	Performance (P_3)	Weighted Performance ($I \cdot P_3$)
Innovation Capacity	3	4	12	3	9	3	9
Supplier Networks	2	2	4	1	2	2	4
Specialized Workforce Issues	5	1	5	4	20	2	10
Economic Infrastructure Linkages	1	3	3	2	2	2	2
Freight and Logistics	1	2	2	0	0	4	4
Weighted Performance (WP)		12	26	10	33	13	29

Table 6-2: Example of a Cluster-Level Transportation Investment Evaluation

The evaluation of investments at a *regional level* is a two-step process beginning with the accounting for the stage of cluster development. Recall from the discussion on development stages, that a resource-constrained transportation planning environment must prioritize cluster investment to effectively allocate investments. Cluster-level evaluations can be aggregated together by weighting the competitive advantage performance of the investment by the development stage of the cluster, as shown in Table 6-3.

Regional Clusters	Cluster Development Stage	Stage Weight (SW)	Airport Capacity Expansion		Rapid Transit Extension		Highway Corridor Capacity Increase	
			WP_1	$WP_1 \cdot SW$	WP_2	$WP_2 \cdot SW$	WP_3	$WP_3 \cdot SW$
Region Cluster RC_1	Working	5	26	130	33	165	29	145
Region Cluster RC_2	Potential	1	19	19	25	25	39	39
Region Cluster RC_3	Latent	3	35	105	12	36	20	60
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Region Cluster RC_N	Working	5	14	70	7	35	13	65
Total Weighted Performance (TWP)			94	324	77	261	101	309

Table 6-3: Example of Transportation Investments Evaluation Across all Clusters

In the example, a higher stage weight (SW) is given to working clusters over latent or potential clusters due to their immediate impact on regional economic development. The investment's weighted performance scores (WP_N) for each individual cluster are summed across all transportation needs after first being multiplied by the stage deriving an overall score for the options. Each transportation investment has now been ranked by its ability to impact competitive advantage on a regional scale. In the hypothetical example, expanding airport capacity is ranked highest, even though its score without regards to stage development is only second best. In this circumstance, the investment best meets the needs of the higher priority, working clusters and is the most effective choice in addressing economic development.

In reality, regional transportation planning occurs in an environment where economic development is just one of multiple criteria such as financial and environmental feasibility, equity, and political issues. Additionally, a regional strategic planning framework considers a family of investment options rather than individual investments. The final step in the evaluation process at the regional level involves summing the competitive advantage total weighted performance (TWP) of each transportation investment in the strategic plan and incorporating it within the ReS/SITE Evaluation Framework as shown in Table 6-4.

Criteria Category	Criteria	Plan A	Plan B	Plan C	...	Plan N
Feasibility	Financial					
	Environmental					
	Institutional					
Effectiveness	Individual Accessibility					
	Freight Mobility					
	Equity					
Competitive Advantage	Cluster Needs (TWP of Plan)					

Adapted from: Conklin, 1999

Table 6-4: Enhanced Structure of the ReS/SITE Evaluation Framework

The total scores are summed for each plan and the result is the ranking of overall regional strategies. A decision-maker using this proposed evaluation tool has the ability to assess strategies at the cluster level and the regional level, addressing competitive advantage in addition to broader feasibility and effectiveness criteria. Strategies with the highest total score could first be deployed by the decision-maker, followed by the next highest, until all strategies were

implemented or all resources expended [153]. The resulting plan typically reflects a long-range infrastructure investment plan, which must also be complemented by a shorter-range systems management and operational component incorporating the same economic development goals as the strategic transportation plan.

6.4 Regional Architecture and Economic Development

Having completed the first two tasks of the chapter, we now turn our attention to making the required adjustments to the notion of regional architecture in order to incorporate economic development initiatives in addition to service and planning activities. Just as transportation service and planning organizations are organized to produce an integrated series of plans, economic development-oriented institutions need to coordinate their initiatives with the implementing organizations. The concept of Regional Architectures should be further differentiated to address the subset of institutions that focus on planning, services, and economic development respectively. The purpose of this is to motivate the development of transportation plans and services that are robust with respect to regional competitive advantage. Figure 6-4 expands Makler's Comprehensive Regional Architecture to include the Regional Economic Development Architecture (REDA) sub-set. The Regional Strategic Transportation Plan (RSTP) now include components which (1) address anticipated transportation investment needs based on the set of possible regional outcomes captured in scenarios – the Regional Infrastructure, and (2) address the set of relationships that describe how the service, planning, and economic development institutions interact to provide an integrated set of transportation plans within a region – the Comprehensive Regional Architecture (CRA).

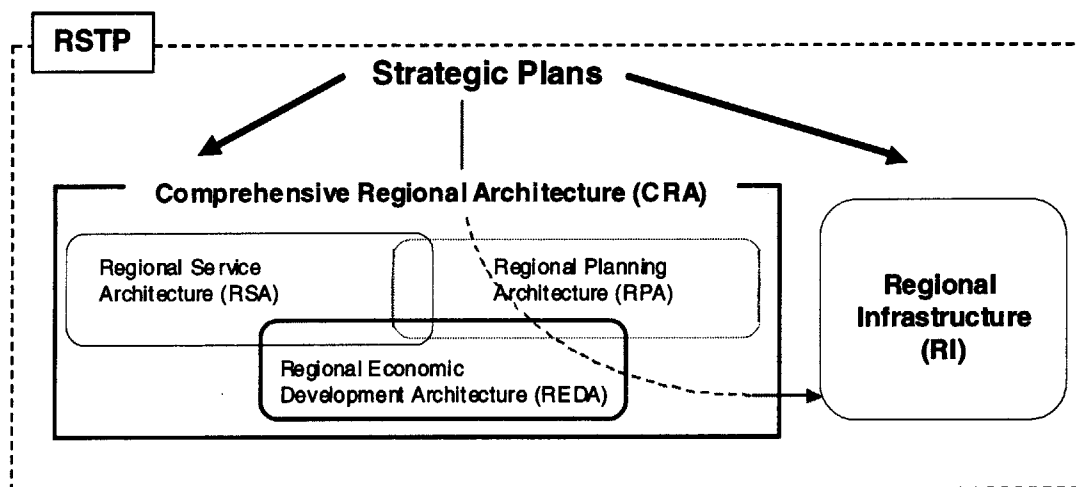


Figure 6-4: Expanded Strategic Plans Component of the ReS/SITE Framework

The link between REDA and RI is very important. Unless consideration is made for economic development policy, the RI strategic plans may not appropriately address the specialized infrastructure necessary to develop or grow a region's competitive advantage. Three important observations can be made regarding Figure 6-4 and the relationships that exist within the RSTP component:

1. Similar to overlap between RPA and RSA, there may be substantial overlap between the REDA and the RPA and RSA. As Makler points out, it would be incorrect to assume that the presence of overlap assures provision of reliable and effective intuitional linkages. Recall from Section 5.2 that the Twin Cities MPO, the Metropolitan Council, undertook responsibility for a detailed cluster initiative in the mid-nineties, yet its regional transportation plans do not frame economic development issues within the cluster context.
2. Makler also argues that the RI and RPA are not discrete and independent elements. The same argument can be made with respect to the REDA and RI. Just as the extent to which the RI is actually deployed is a function of the RPA's ability to develop and implement it, so to will the RI deployment depend on the REDA's ability to identify and prioritize investments which support competitive advantage, and integrate within the RPA and RSA elements.
3. The addition of the REDA now enables the Strategic Plans component of ReS/SITE to incorporate planning responsibilities covering each of the three necessary conditions, identified by Banister and Berechman in Section 3.3, required before economic development can occur, as shown in Figure 6-5.

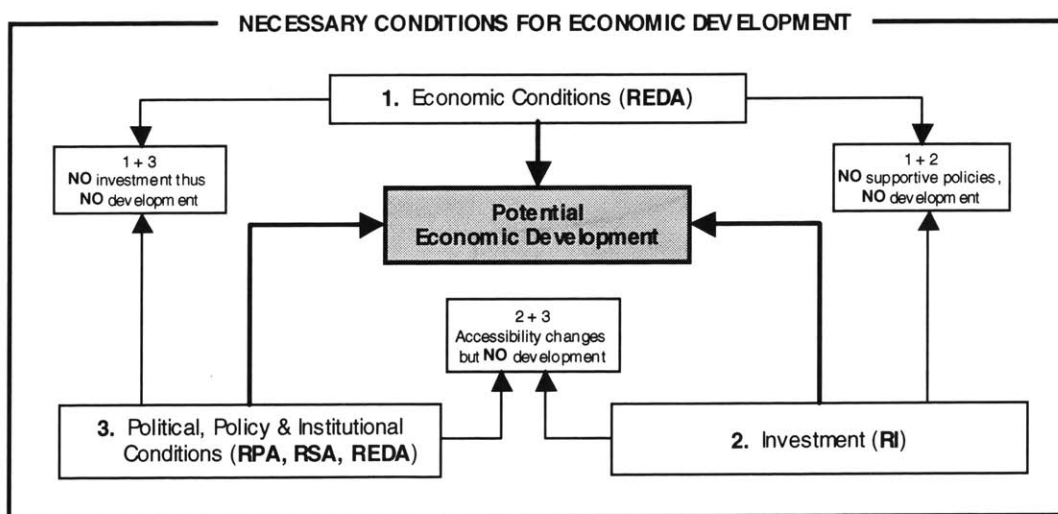


Figure 6-5: RSTP and the Three Necessary Conditions of Economic Development

Planning related to *regional economic conditions* is contained within the REDA architecture, while *political, policy, and institutional conditions* is jointly contained within the RPA, RSA, and REDA architectures. Finally, the actual *investment* is contained within the RI. The presence of planning responsibilities for the three necessary conditions within the RSTP does not assure that economic development will occur within the region; however, the exclusion of one of the components will result in, at best, limited economic impact. The ReS/SITE framework now involves a more descriptive analysis of a strategic transportation decision-making process incorporating the important elements of regional competitive advantage.

6.5 The Extended ReS/SITE Framework

The fourth and final task is to present the revised and extended ReS/SITE framework in complete form. The final modification is minor, merely the addition of the overlapping Regional Economic Development Architecture within the RSTP shown in Figure 6-6.

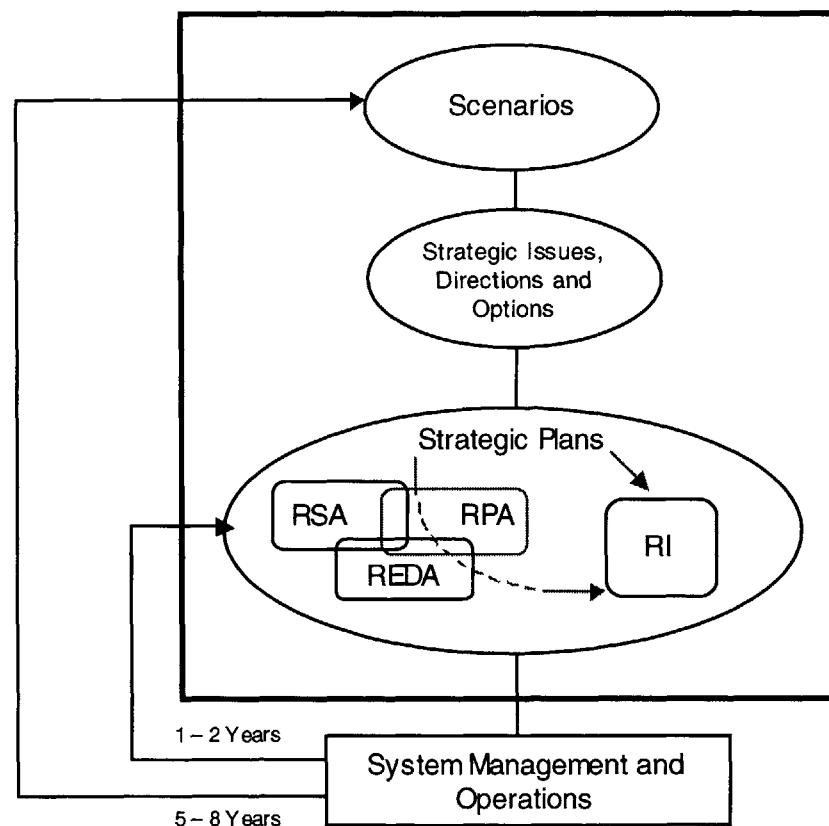


Figure 6-6: The Extended ReS/SITE Framework

Contained within the framework are other implicit links to regional economic development. The ReS/SITE *Scenario* component permits multicriteria evaluation of alternatives to include regional competitive advantage needs and potential outcomes. Cluster development scenarios, similar to those addressed in Section 2.5.1, can be incorporated into a robust collection of potential futures for a region. Cross-cutting and targeted actions to sustain or enhance cluster competitive advantage are the outcomes of the collaborative strategy phase of a cluster initiative, and can be incorporated within the *Strategic Issues, Directions, and Options* component of the framework. The inclusion of REDA within the *Strategic Plan* component recognizes the need for institutional and information relationships between transportation and economic development planning stakeholders if economic issues are to be effectively incorporated within regional transportation plans. Finally, within the *System Management and Operations* component, specific performance measurements can be implemented evaluating the effectiveness of the investment to regional competitive advantage, rather than general economic growth objectives.

6.6 Implications

Before summarizing the implications of the extended ReS/SITE framework, the remaining task is to integrate the Cluster Initiative Architecture with the Regional Planning Architecture established by Makler and was presented earlier in Figure 4-6. The intention is to now modify Makler's RPA to reflect the addition of the economic development institution and planning components. The placement of the cluster initiative is straightforward, with several institutions of the RPA involved through their roles as economic input representatives and eventually the potential implementation of cross-cutting cluster growth actions within regional transportation plans. The RTP plan boundary has been slightly modified to reflect the fact that it overlaps with both the RASP and the Transportation Blueprint, both important within the cluster context. The resulting revised RPA is shown in Figure 6-7 incorporating both transportation planning and economic development elements.

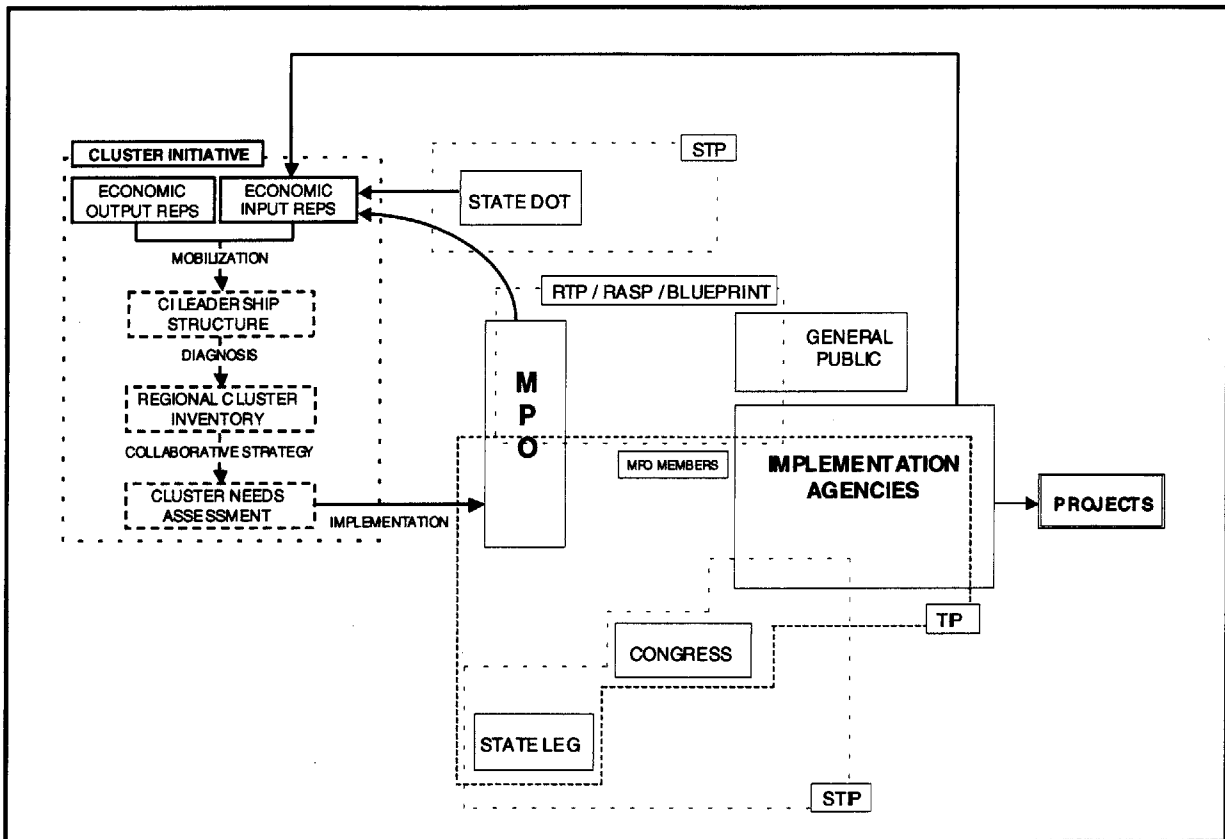


Figure 6-7: The Revised Regional Planning Architecture

The central role of the MPO within the revised RPA remains, but with an important distinction. Though the MPO might play an active role in the cluster initiative, it usually does not have the institutional capacity to lead the initiative. The cluster initiative, undertaken in order to support the development of regional competitive advantage, effectively employs the Regional Planning Architecture, meaning that the ReS/SITE framework is dependent on the pre-existence of a cluster initiative if it is to effectively incorporate regional competitive advantage within its components. This relationship makes sense given the prior arguments in this thesis. Transportation investment alone cannot result in economic development as we have defined it here, and is dependent on the interaction with other necessary conditions for the potential that economic development occur. Having the competitive advantage theory reside wholly within the ReS/SITE framework would violate this observation. The integration of the Cluster Initiative Architecture with the CRA represents several other additions to the transportation planning context: (1) it addresses a frequently cited shortcoming in current practice by including institutional linkages between regional businesses and the transportation planning and service organizations; (2) the evaluation of transportation infrastructure within the context of economic

development has been linked with the theory of regional competitive advantage; and (3) the transportation and economic development cycles are linked more closely together.

This discussion, which has focused on linking transportation investment to competitive advantage, may give the impression of an over-importance of transportation to the competitive advantage of a region. A critical look at the framework reveals several potential shortcomings:

1. Few examples of cluster initiatives actually exist which provide the level of detail required by the framework to make an effective assessment of a cluster's specialized transportation needs.
2. It is not immediately apparent which specialized transportation investments actually support a specific type of cluster's competitive advantage.
3. A lack of empirical detailed cluster studies makes it difficult to evaluate the applicability of the extended framework in practice.
4. The case studies presented in Chapter 5, except the state-wide Florida study, were performed at the metropolitan level. More commonly, the cluster study is performed at the state level which: (1) may not provide enough detail for an MPO to integrate cluster needs within its region-level plans, or (2) may overlook clusters which cross state boundaries but are still important when considered at a metropolitan level.
5. The framework does not specifically translate the economic development and cluster specialized transportation needs to shorter-range operational and system management plans, nor does the framework provide appropriate measures for evaluating these short-range plans within the context of regional competitive advantage.

The preceding discussion has responded to Sussman and Conklin's call to more fully explore the regional strategic planning framework within the context of regional competitive advantage and economic development. This discussion has produced an extended ReS/SITE framework which attempts to link economic development related-transportation investments to competitive advantage theory. While progress has been made, empirical "proof" of the usefulness of this construct remains. The thesis will conclude by assessing the New England region's transportation and economic development planning environment within the context of this extended framework.

Chapter 7. Evaluating the New England Region

The purpose of this chapter is to examine the New England region of the United States within the context of the extended ReS/SITE framework presented in Chapter 6. To accomplish this, the first task is to assess the degree to which New England may in fact be regarded as an economic region, the important scale unit for regional competitive advantage. The next task will be to explore the economic development and transportation planning organizations which exist at a regional scale, and the cross-cutting transportation issues affecting New England. The final task will be to assess New England cluster initiatives and their integration with transportation planning as suggested by the extended framework. It is hoped that regional transportation investment decisions may be better evaluated as a result of this overview. The chapter concludes with a critical assessment of the usefulness of the extended ReS/SITE framework.

7.1 The New England Region

The New England region is composed of the six states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. Located in the furthestmost northeast corner of the United States, these states cover only 2% of the total area of the country, with approximately 13 million people, or 5% of the national population [154]. The region together is approximately the size of one typical Midwestern state, and had the country been settled from West Coast to East Coast, the region would likely have formed one single state, rather than six. The six states of New England are linked by their history, sharing of multiple disadvantages of a poor natural resource base (except for water), harsh climate, aging infrastructure, high energy costs, an aging and slow-growing population, and a historical over-dependence on defense industries. Each also shares in the advantages of a skilled workforce and a concentration of higher education institutions.

Though generally recognized as a “region,” it is somewhat unclear what specifically ties these six states together beyond their proximity. In 1999, the New England Board of Higher Education surveyed 1,000 New England opinion leaders, including academics, state legislators, public policy think tanks, mayors, members of the media, community leaders, and business executives. The New England opinion leaders were asked to characterize the qualities that define New England as a region. Simultaneously, 1,000 randomly selected households within the region were asked to undertake the same exercise. The results are summarized in Table 7-1:

<i>New England Opinion Leaders</i>		<i>New England Households</i>	
Characteristic Defining New England as a Region	Percent Responding	Characteristic Defining New England as a Region	Percent Responding
History and Traditions	98%	Geography and Climate	91%
Education Institutions	96%	Educational Institutions	90%
Climate and Weather	93%	Quality of Life	90%
Geography	91%	Economy	80%
Technology-based Industry	78%	Sports Teams	67%
Political Culture	74%		
Economy	68%		

Adapted From: New England Higher Board of Education, 1999

Table 7-1: Characteristics Defining New England as a Region

Although the states share a history and geographic location, they do not necessarily constitute an economic region, the important scale unit for competitive advantage analysis. New England opinion leaders do not have a strong consensus that the economy binds the six separate political jurisdictions into a single region. Indeed, more opinion leaders felt a subset of the regional economies, technology-based industries, characterized New England as a region than did the broader regional economy. Certainly, there are different implications for policy if New England is simply a “high-tech” region versus an integrated “economic” region. Furthermore, there are examples of artificiality to the regional boundaries. For instance, Connecticut as a whole, and certainly Southeastern Connecticut, largely ignores the regional economic hub, Boston, relating more intensely to the agglomeration around New York City.

Using Pendleton’s (1998) framework for comparing economic regions to political jurisdictions introduced in Section 2.1.1, we can gain some insight to the degree to which New England can be regarded as an economic region. The geographic orientation of New England is contiguous, with the six states coexisting within the same spatial area in the United States. Because this characteristic is shared by both economic regions and political jurisdictions, it offers no additional insight. The characteristics of the borders of New England are split between the two classifications. By having borders distinctly geographically based and fixed over time, New England is seen more as a combination of political jurisdictions. On the other hand, there is a large degree of “economic spill” across borders such as, for example, the Boston economic region’s reach into both southern New Hampshire to the north and into Providence, Rhode Island to the south. Economic activity varies greatly across the region, both internal to individual states and the region as a whole, contrasting as an example, eastern Massachusetts and Boston with the western area of the state which is primarily rural. Similarly, the economy paralleling the I-95 corridor of Connecticut bares no resemblance to any portion of rural Maine. New England’s

relationship with other regions is interdependent. For instance, the low cost of doing business in the U.S. “South” has had a negative impact on the higher cost region of New England in its ability to retain and attract manufacturing industries. Finally, the large rural makeup of New England provides comparatively little amount of economic activity, and if the region was truly defined by its economy, large portions of each state would be excluded from the definition of New England. Instead, these rural areas are integrated within the jurisdictions of the six states. Table 7-2 illustrates that New England is neither specifically a distinct political jurisdiction nor a distinct economic region. For the purposes of exploring the integration of competitive advantage and regional transportation planning, we must assume that New England is more than a collection of its political jurisdictions. However, to do so, we will first explore for several further aspects of the region including the degree to which industries are shared between states, the make-up of its workforce, and the degree of cooperation existing between the six states.

New England Characteristics	Economic Region	Political Jurisdiction
<i>Geographic Orientation</i>	X	X
<i>Borders</i>		
Definition		X
Clarity		X
Variation over Time		X
Relationship with Other Borders	X	
<i>Internal Diversity</i>	X	
<i>Relationship with Similar Entities</i>	X	
<i>Integration of Rural Areas</i>		X

Table 7-2: New England: Economic Region or Collection of Political Jurisdictions?

New England Economic Sub-Regions

When looking at the region, observers often equate the New England economy with the economy of Greater Boston, but the regional economy is obviously much more complex. For example, only the health services industry is among the top 10 industries in each New England state, as measured by an industry’s contribution to gross state product and share of state employment [155]. In reality, New England is composed of several economic sub-regions among which are:

1. The area encompassing Route 128 outside of Boston, the southern tier of New Hampshire, and the I-95 corridor to Providence, featuring one of the highest concentrations of high-technology employment in the nation, as well as significant biotechnology and financial services industries

2. The Connecticut River Valley, including parts of Massachusetts, Connecticut, New Hampshire, and Vermont featuring concentrations of traditional manufacturers, including machine shops
3. Rural New England, including large parts of Maine, Vermont, New Hampshire, and Massachusetts feature concentrations of natural resource-related industries, including tourism
4. Southern Connecticut characterized by concentrations of financial service industries and linked very closely to New York City, outside the traditional boundaries of New England
5. Portions of Rhode Island and Connecticut sharing a significant manufacturing belt

Each of these sub-regions has different needs and concerns. Greater Boston and the southern tier of New Hampshire may be more concerned with advanced education and training, as well as preserving a high quality of life to attract and retain high-tech professionals, while rural New England might focus on preserving its environmental character and promoting tourism. In each case, analyzing state by state needs limits the ability to distinguish the true economic concerns of distinct sub-regions within the region.

New England Industries

In the past, New England tended to be more dependent on particular industries, rather than a broad base of concentrated firms. Shipping, textiles, leather, and manufacturing industries historically played a major role in the region's economy. The economic wealth created by these industries funded construction of the now aging infrastructure of utility systems, railways, and highways. As some key regional industries moved to the South and overseas, replacement industries emerged such as fabricated metals and electronic components, giving way in the mid-twentieth century to computers and defense-related manufacturing. More recently, the region has undergone a significant change, shifting from manufacturing to service industries at a faster rate than the national economy as a whole [156]. In 1997, manufacturing accounted for only 19% of New England's employment, down from 30% in the 1970s [157]. The shift to service industries such as business and financial services, biotechnology, legal services, and the like was fueled in large part by the competitive strength of New England's higher education institutions. Many service industries are now over represented in New England as measured by national employment share, as summarized in Table 7-3.

Industry	1997 New England Share of National Employment (%)
Investment offices	31.1
Security and Commodity Services	19.0
Pension, health, and welfare funds	16.0
Life Insurance	14.6
Colleges and Universities	14.0
Savings Institutions	13.5
Libraries	12.8
Museums and art galleries	8.6
<u>Medical and health insurance</u>	<u>8.5</u>
<i>All New England Businesses</i>	<i>5.6</i>

Source: Kolko, 1998.

Table 7-3: New England Service Industry Concentration

While all New England businesses accounted for only a 5.6% share of the national employment, several service industries exhibited much higher employment concentrations than average.

New England Population and Workforce

New England has long been recognized as having a well-educated, highly-skilled workforce. However, a major threat to the regional economy is the slow to negative growth of this labor force. The U.S. population expanded at a rate five-times that of New England between 1990 and 1998. For the same time period, the New England labor force averaged an annual increase of zero percent [158]. Overall, the average state rank in population growth in the 1990s was in the bottom third of the nation, with Connecticut, Rhode Island, and Maine among the four slowest growing states in the nation. The population and workforce, although stagnant in growth, ranks in the top third of the nation in productivity and income growth over the past twenty years, and maintains the highest per-capita income of any U.S. region [159].

New England Regional Cooperation

The New England Board of Higher Education survey cited early in this section also polled New England opinion leaders as to the most urgent issues facing their individual states. There was a strong tendency towards consensus on regional priorities with, for example, “expanding the skilled labor force” ranking as the first or second most urgent issue in each state, and “infrastructure improvement” ranking in the top four policy issues in each New England state. Furthermore, 86% of New England opinion leaders felt the region should work collaboratively

toward regional goals, although importantly, only 26% of these same leaders had actually worked on projects with government entities or organizations from other New England states [160]. Given shared regional priorities as well as the common disadvantages cited earlier, cooperation between the New England states would appear to be more common than it actually is. Further advantages to cooperation can be seen when the region is examined at the national political level. Cooperation would give the region more influence in the U.S. Senate, where New England's members outnumber California's by twelve to two. At the same time, the region's population-based delegation in the U.S. House of Representatives is the smallest among all regions and shrinking, lending further credence to the need for cooperation. Even given the advantages of cooperation, there are barriers to regional cooperation that the simple constraints of state and municipal jurisdictional boundaries, including:

1. Strong resistance to relinquishing local and state control to regional authorities
2. Historical competitive tendencies among the six New England States
3. Public support for regional cooperation in New England has often been motivated by the self-interest of individual states and organizations, rather than the broader interests of the region.

Despite these barriers to cooperation, the overall assumption that New England constitutes an economic region stands for the purposes of this research. Shared priorities, disadvantages, and multi-jurisdictional economic sub-regions all contribute to this assumption. Before looking at the cluster initiatives undertaken in New England and their link to strategic transportation planning, we will first explore the inventory of New England's regional organizations, as well as transportation issues which are shared by the entire region.

7.2 New England Regional Organizations

Over the past half-century, dozens of interstate compacts and regional organizations have been established in New England, but few remain, and even fewer are thriving. Presently, there is no true common regional approach to economic development within New England. In the early 1990s, legislators from several states considered the creation of the New England Compact for Economic Development, an agreement whereby any New England state losing out in competition for a business would align its support behind another New England state still in the running, with the reasoning that, for example, Connecticut would be better off when a business locates in Massachusetts rather than Texas or California. After ten years, the Compact still has not been

ratified by any state. Another example is the New England Governor's Conference, which in the late-nineties was a fraction of its former size, and received the lowest funding of any regional governor's organization in the U.S. [161]. A symptom of the lack of a regional economic development approach is the effort expended by Vermont, New Hampshire, and Rhode Island in urging Massachusetts companies to relocate to their states, though more recently, Rhode Island has shifted to one of promoting expansion of companies within Rhode Island, rather than relocation. Luring business away from neighboring states has historically been both an explicit and implicit economic development goal in New England.

Section 6.2 noted that the critical first step of any cluster initiative is the assembly of all key stakeholders relevant to the economic development effort being undertaken. While to date, no comprehensive cluster initiative has been performed encompassing the entire New England region, a brief inventory of existing regional institutions, both economic development and transportation related, serves as a useful exercise in understanding the relevant regional economic institutions. While the following list is not comprehensive, it strives to capture the primary stakeholders which currently exist, and the relatively short list is indicative of the limited cooperation and coordination currently taking place at the regional level.

Regional Economic Development Organizations

The New England Governor's Conference (NEGC): The NEGC has existed as an informal alliance since the American colonial era, but was formally established in 1937 during the depression to promote New England's economic development. Since then, the organization has been incorporated as a non-profit corporation, with the region's six state governors serving as its Board of Directors. The NEGC is structured so that, in theory, the Governors are able to work together to coordinate and implement policies which are designed to respond to cross-border regional issues. Specifically, the NEGC manages committees, made up of government officials from each state, which are periodically formed to address regional policies.

New England Board of Higher Education (NEBHE): The NEBHE was created in 1955 as a private, non-profit, educational organization by the governors of the six New England states, and subsequently granted official authorization by each state legislature and the U.S. Congress. Each state is individually represented on the board by eight delegates appointed by their respective state governor. Among the goals of the organization are: (1) analyze and publish regional information related to higher education and regional economic development; (2) explore and strengthen the connection between higher education and economic development in New England;

and (3) promote regional coordination and efficient use of economic resources among New England's six state governments and the region's public and private colleges and universities.

New England Public Policy Collaborative (NEPPC): A operating unit of the NEBHE, the NEPPC was created in 1998 specifically to foster cooperation on behalf of the region's economic development. The Collaborative brings together over 300 public policy centers and institutes from around New England.

New England Economic Project (NEEP): NEEP is a non-profit organization founded in 1975 to provide objective economic analyses and forecasts for the New England region. The organization also facilitates research on regional economic issues and periodically conducts forums examining developments in the New England economy. For example, in 1999, NEEP conducted the forum "New England: Global Transportation Hub or *Cul de Sac*?" examining issues in the region's infrastructure and their impact on the regional economy. Members of the organization represent academic institutions, government agencies, regional utilities, and industry. Though several government agencies are represented in NEEP, notable is the absence of transportation planning and service organizations.

Federal Reserve Bank of Boston: Though primarily known for its monetary policy programs, the District One Federal Reserve Bank, located in Boston, serves the six states of New England by conducting economic research on regional issues, public policy analysis, and interpretation of regional conditions and developments in the economy. Three of its publications focus on the New England economy, including (1) *Regional Review*, a bimonthly journal on regional economics and public policy; (2) *New England Economic Review*, a quarterly publication focusing on topics relevant to the New England economy; and (3) *New England Economic Indicators*, a monthly compilation of select current and historical statistics on the New England economy. Each of these publications has occasionally focused on transportation infrastructure issues over the past decade.

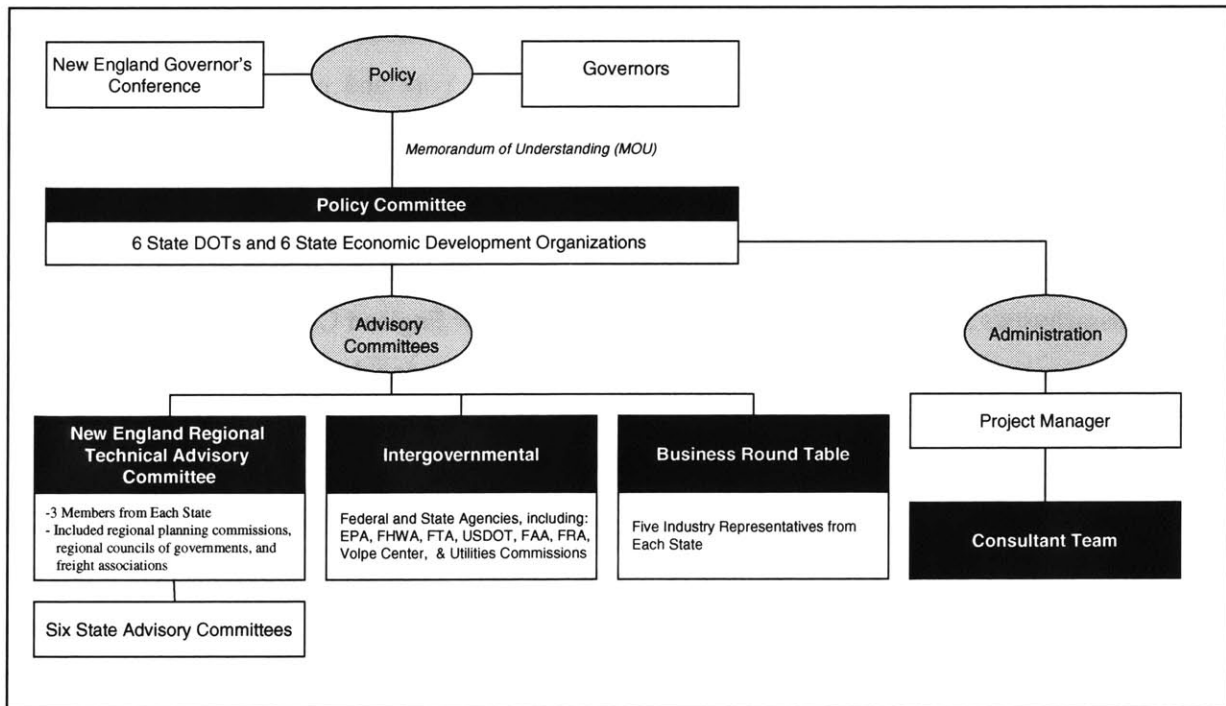
The New England Council: The Council was formed in 1925 by regional business leaders and New England governors in response to a mass exodus of New England textile and shoe manufacturers to the southern United States. The Council claims to be the nation's oldest regional business organization, and currently is structured as an alliance of business, academic, and public organizations throughout New England promoting both economic growth and a high

quality of life for the region. Like NEEP, several government agencies are represented on the council, but again absent are transportation planning and service organizations.

Coalition of New England Companies for Trade: The Coalition is a lobby group, located in Washington D.C., representing regional New England companies involved with international trade.

Regional Transportation Organizations

New England Transportation Initiative (NETI): This initiative was a cooperative venture of the six New England states to develop a coordinated strategic transportation planning vision for the region. Directed by a policy committee consisting of representatives from the state DOTs, EPA, and Economic Development agencies, the two year program was undertaken at the request of the New England Governor's Conference between 1994 and 1995. NETI included industry representatives from each state and its organizational structure, shown in Figure 7-1, broadly represented transportation issues at both the state and regional levels.



Adapted From: Cambridge Systematics, 1995.

Figure 7-1: NETI Organizational Structure

New England Transportation Consortium (NETC): NETC is a cooperative effort of the New England state transportation agencies and the state universities in the region. Its goals are the development of improved methods of dealing with common transportation problems, focusing

primarily on issues affecting the planning, design, construction, maintenance, and rehabilitation of the region's highway network.

New England University Transportation Center (UTC): The New England UTC is one of ten Federally sponsored regional research centers whose missions are to be a resource for research and education in both passenger and freight transportation. The centers are intended both as a national resource, and as means to address coordinate transportation research and education programs with regional needs and initiatives. The New England UTC, housed at MIT, includes the six state universities as well as Harvard and MIT.

I-95 Corridor Coalition: The Coalition was created in 1993 by the transportation agencies in the congested, and multi-modal I-95 northeast corridor. With federal funding assistance from the USDOT, the Coalition has become more policy directed over the past eight years. Initially focused around the coordination of ITS within the corridor, the role has expanded to addressing mobility needs over multiple transportation modes, and addressing the need to improve the economic vitality of the region. Beyond simply the state DOTs and ITS related organizations, coalition membership extends to Amtrak, the Federal Railroad Administration, the Federal Transit Administration, and the Port Authority of New York and New Jersey. Beyond New England, the Coalition also includes the states of New York, Pennsylvania, Delaware, Maryland, and Virginia.

New England Regional Air Service Initiative: A collaborative effort between the FAA, Massport, Massachusetts Metropolitan Airport Commission, the New England Council, and regional airport managers to investigate regional solutions to meet ever increasing demand for air travel.

7.3 Cross-cutting Transportation Issues for New England

Up to this point, we have established that New England may be regarded as an economic region, and it has, to a limited extent, regional economic institutions that act as stakeholders in promoting and undertaking regional initiatives. Our final task before exploring specific cluster initiatives and regional transportation planning is to ascertain what transportation issues and infrastructure are shared across the region.

Regional Transportation Infrastructure - Priorities and Investment

In 1998, the National Council of State Governments analyzed the state-of-the-state address of state governors and compiled the top priorities. At the state executive leadership level, Table 7-4

demonstrates that neither transportation nor economic development was a top priority for all six New England states.

State	K-12 Education	Environment	Tax Cut	Higher Education	Economic Development	Transportation Investment
Connecticut	X	X	X			X
Maine			X		X	
Massachusetts	X		X			
New Hampshire	X					
Rhode Island	X	X	X			
Vermont		X	X		X	X

Adapted from: Pierce, 1998.

Table 7-4: New England Governors' Top Priorities

Other opinion leaders do not necessarily share this opinion, as the results from the NEBHE survey demonstrate. The majority of respondents felt that economic development and select inter-state transportation investment would be effective regional strategies.

Survey Question	% Responding Strategy would by "Somewhat" or "Very Effective"						
	CT	ME	MA	NH	RI	VT	New England
<i>Regional agreement to support economic development efforts by neighboring New England states.</i>	79%	75%	82%	82%	81%	77%	80%
<i>Regional development of high-speed rail network connecting New England cities.</i>	78%	70%	78%	75%	83%	54%	76%
<i>Joint planning to expand capacity of New England's regional airports</i>	75%	76%	75%	71%	70%	76%	74%

Source: The New England Board of Higher Education, 1999.

Table 7-5: Effectiveness of Economic Development and Transportation Investment Strategies

When examining the level of New England's overall infrastructure spending, it is found that the region invests a slightly lower percentage in infrastructure relative to economic output than the national average. Various factors contribute to this finding, including pre-existing investments in infrastructure due to the age of the region compared to the rest of the country, and higher productivity levels of the region's well-educated, and highly skilled workforce. In 1994, New England invested \$5.4 billion in public infrastructure, including roads, bridges, highways, mass transit systems, railways, waste treatment facilities, and so forth. This amount equated to approximately \$14 million in public investment for every \$1 billion in regional economic output,

slightly less than the nation as a whole at \$16 million in infrastructure investment for every \$1 billion in economic output. Spending levels varied from a low of \$7 million per \$1 billion output in New Hampshire to a high of \$17 million per \$1 billion output in Massachusetts. Transportation investment represents the vast majority of infrastructure spending in the region. In 1994, New England invested approximately \$3.2 billion, or 59% of all infrastructure spending, in transportation related projects [162]. While much of the investment may have been in projects which primarily benefit specific states within the region, New England shares an extensive regional transportation system, as shown in Figure 6-2.

Interstate Highway System and I-95

The priority corridors for passenger ground transportation in New England are effectively defined by the interstate highway systems shared within the region: (1) I-95 in five of the six states, except Vermont, (2) I-93 in Massachusetts and New Hampshire, (3) I-91 in three of the six states, (4) I-89 in New Hampshire and Vermont, and (5) I-84 in Connecticut and Massachusetts. Other Interstate Highway corridors are contained within individual states (e.g. I-90 in Massachusetts), but are not as relevant within the regional context.

The obvious priority for regional planners would be to focus on I-95 as it is the primary linkage between the New England states and the rest of the Eastern seaboard. Between Maine and Virginia, I-95 passes through a commercial corridor containing almost a quarter of the American population. Along this corridor, it is the major highway feeding thirteen major airports (including four within New England), 11 major seaports, and more than two dozen major railroad stations.

Congestion along this corridor has been a regional issue for many years. Key congestion choke points, such as between New Haven and New York, limit New England's highway connectivity with the adjoining Mid-Atlantic region. The Connecticut portion of I-95 is operating at 180% of designed capacity [163], with the section between Stamford and Greenwich ranking as the region's busiest highway, at over 132,500 daily vehicle miles per mile of highway. This ranking is also twelfth in the nation, though significantly behind Los Angeles' 200,000 daily vehicle miles per mile of highway. Altogether, Connecticut has four metropolitan areas within the top fifty national congested highway rankings, with the only other New England municipality in the top fifty being Boston with a national ranking of eighteenth [164]. Troublesome for Connecticut is that the congestion comes at a time when the state has had no population growth for more than a

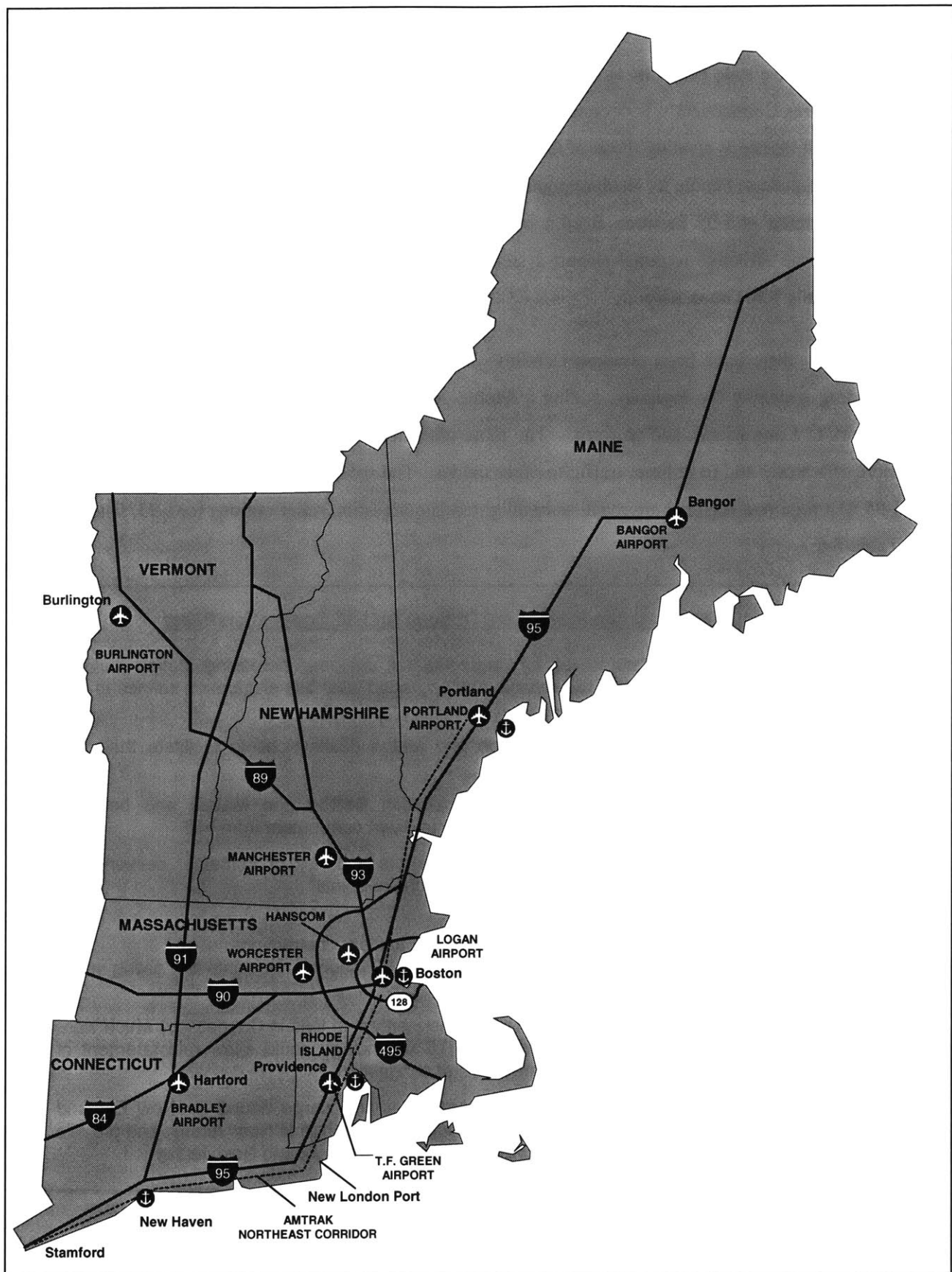


Figure 7-2: New England Regional Transportation Network

decade, and the state economy as a whole grew slower than the nation in the 1990s. Even rural Maine shares Connecticut's I-95 congestion, albeit seasonally, when four to five million tourists create peak demands rivaling those of Connecticut. Although Maine's highway infrastructure is mostly adequate to handle its resident population demands, it is overwhelmed during the summer. For the stretch of I-95 between Boston and Providence, congestion could limit the ability to implement an effective regional airport system if passengers are unable to conveniently access Providence's T.F. Green Airport.

In the past, there have been seemingly endless discussions surrounding I-95 capacity expansion including widening the highway, adding a double-deck, building a parallel corridor and bridge network to Long Island, and so forth. The more realistic solution is using the current capacity more efficiently and to redirect traffic to other modes. The solutions for relieving congestion on I-95 will require a regional approach as highlighted in congestion relief options for I-95, listed in Table 7-6.

Select Transportation Investment Options for I-95 Congestion Relief

1. Diversion of commuters to rail by upgrading rail stations, increasing station parking, improving the frequency of rail service, and upgraded local bus distribution service to and from the rail stations
2. Improved intercity rail between Boston and Maine destinations to facilitate the peak summer tourist traffic
3. Investment in high-speed ferry service between Boston and Maine, and between Connecticut, Long Island, and New York City to divert commuters from I-95
4. Diversion of truck freight traffic to coastal barges and rail, or container delivery and pickup to alternate ports away from congested choke points⁴
5. Investment in ITS
 - a. Finding quicker and more effective ways to clear obstructions
 - b. Persuading drivers to stay away from I-95 during incidents by giving more accurate and prompt information
6. Investment in demand management and reinstatement of tolls in Connecticut which were removed in 1990 to relieve congestion. ITS technology could allow reinstatement of these tolls without creating the same levels of congestion
7. Upgrade the port in New London, Connecticut so that cargo bound for New England could be unloaded north of the I-95 choke points, rather than in New Jersey, and provide meaningful congestion relief on I-95 southwest into New York and New Jersey

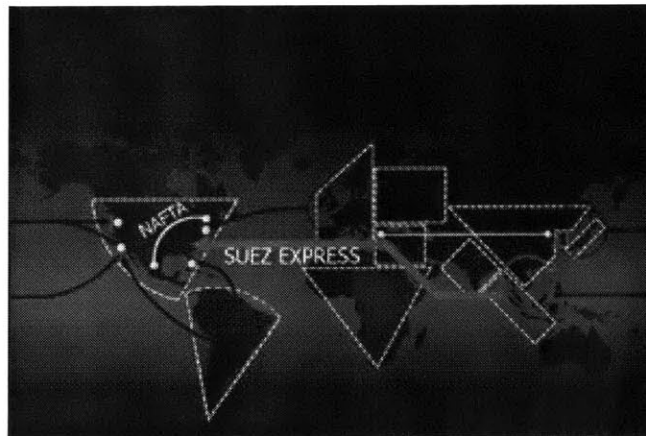
Table 7-6: Transportation Investment Options for I-95 Congestion Relief

⁴ 80% of freight in Connecticut is shipped by highway; with 12%-13% of the vehicles on I-95 each day are trucks, compared with only 8% on nearby I-84 (Source: Gallis, 1999).

For any of these options to succeed, they must be managed over multiple state boundaries, as well as regional boundaries when New York City is taken into consideration. The desired change in behavior of both passengers and freight carriers is not confined within a single state or municipality, and the infrastructure and technology investment must be coordinated within this multijurisdictional reality.

New England Freight Infrastructure and Global Trade

Despite New England's historical prominence as a center of water-borne commerce, its ports have diminished in importance relative to other cities on the eastern seaboard, in particular, the Ports of New York and New Jersey, Baltimore, Charleston, and Halifax, Nova Scotia. In addition to the region's dramatic loss in port prominence, it is also facing changing trade patterns due to the globalization of trade and international trade agreements within the past decade. The world's fastest growing trade route, called the Suez Express Corridor, links South Asia, the Indian subcontinent, the Mediterranean, and the U.S. East Coast, as shown in Figure 7-3. Goods reaching the East Coast from South Asia via the Suez Canal take only one to two days longer than goods shipped by sea to the West Coast, then across country by rail, but transport costs are up to 50% less [165]. In the 1980s, there was no westbound container traffic from Asia to the United States, but by 1996, 6% of all container traffic passed through the Suez Express Corridor, with traffic expected to grow at an annual rate of 8% [166].



Source: Michael Gallis and Associates, 1999.

Figure 7-3: The Suez Express and NAFTA Trade Corridors

One of the fastest growing *continental* trade routes is the NAFTA Corridor, linking Canada to Mexico through the U.S. Midwest. Prior to NAFTA and the large growth in Pacific imports, the primary highway and rail connections were national rather than continental and ran from east to

west. Some economists believe that much of the new growth in manufacturing and logistics jobs will be along both the north-south NAFTA Corridor, and the ports and east-west rail lines connecting this corridor to the Suez Express Corridor. Absent any intervention, it is likely that the trade network will continue to evolve to the north of New England in Halifax, Nova Scotia, and to the south in New York, New Jersey, Norfolk, and Charleston.

If New England fails to enhance the efficiency of freight movements to and from its own markets, Asia, Europe, and the NAFTA corridor, the region could face a future of increasing transportation costs which impact business location decisions, increasing dependence on truck transportation for goods movement with implications for highway congestion, and ultimately, the region's competitive advantage through the inefficiency of an important factor input to the economy. Despite this risk, there appears to be no regional strategy around port development and intermodal freight infrastructure, though individual New England states are investing in their own ports under the auspices of remaining competitive; in reality they are competing for a diminishing share of New England ocean shipping traffic. For example, in the late-1990s, over \$200 million of capital improvements were made at the Port of Boston, yet the seaport fell behind Portland, Maine in the amount of cargo handled at its docks, with the port receiving only one trans-Atlantic ship each week [167]. Besides the investment in Boston, Rhode Island and Connecticut are each evaluating major investments in their port infrastructure. Of all the ports, only Portland, Maine recognizes its primary role, not as a major origin and destination port, but as a container feeder service to Halifax [168].

In addition to ocean-going trade, the region must be concerned with air freight, which is the fastest growing mode of cargo transportation within the region. New England's shift to a high-tech economy has increased the importance of air freight over ocean freight. In 1998, the total value of all export shipments by air from New England was \$18.5 billion, while the total value of all export ocean shipments was just under \$5 billion. From Boston's Logan Airport alone, air exports have grown from \$6.5 billion in 1998, to over \$10 billion in 1999, and in terms of air cargo volume handled, Logan now ranks eighteenth among U.S. airports, and thirty-fourth in the world [169]. Airport capacity and access issues threaten this segment of shipment, especially in the Boston area, as the air cargo handlers are typically faced with the same congestion as are air passengers. In general, the New England region faces multiple intermodal freight challenges, including:

- Limited regional doublestack rail service, especially at its ports, which prevent cost and time efficient intermodal transfers of containers. This service is available in competing eastern seaboard ports of Halifax, the Port of New York and New Jersey, and Baltimore.
- Limited frequency of container vessel service making it difficult to justify and recoup port infrastructure investments
- Inefficient competition for port traffic between New England states
- Major capacity and delay impacts at the regional air cargo hub at Logan Airport
- Aging freight infrastructure developed for traditional manufacturing exports and lacking the specialized characteristics necessary to handle the regions shift to time-sensitive high-tech exports

As was the case for New England's highway needs, proposed solutions to the freight issues will require a regional approach if they are to be effective. A select number of investment options are listed below in Table 7-7:

Select Transportation Investment Options for New England Intermodal Freight

1. Secure double-stack rail access to New England ports, including on-dock rail infrastructure and the necessary investment to raise bridge clearances to the necessary heights
2. Select and invest in a single regional large-scale container port. A proposed site, though controversial, is at Quonset Point, Rhode Island. With the proper investment, the port would offer New England the following three critical freight needs: (1) proximity and deep-water access to the North American sea lanes; (2) on-dock rail access; (3) double-stack rail access to the NAFTA Corridor [170]
3. Investing in port dredging to remain competitive, with the ability to serve the current generation of mega-container ships
4. Develop a regional airport into an air freight niche airport
5. Enhance efficiency of Canadian border crossings to capitalize on proximity to the nation's largest trading partner
6. Creation of a New England Regional Intermodal Freight Alliance to assist states in the development and implementation of strategic, intermodal, and regional approaches to the movement of goods in New England [171]

Table 7-7: Transportation Investment Options for New England Intermodal Freight

New England's Regional Airport System

Air transportation is especially critical to New England, which lies in the northeast corner of the nation, making it unsuitable as a major hub. An efficient air transportation network can dramatically reduce this geographic handicap. The major issue of regional significance is the overdependence on Boston's Logan Airport, which experiences significant ground- and air-side congestion. Logan Airport has the advantage of being virtually downtown, but has not seen significant investment in capacity for more than twenty years, and is among the nations most congested and delay-prone airports. Because Logan Airport is surrounded by water and residential neighborhoods, adding new runways is difficult. The notion of a second major airport in Greater Boston has been long debated by local politicians and business leaders, but the idea has essentially been abandoned as politically impossible. The negative impacts of Logan congestion are multifaceted, but within the regional competitive advantage context, congestion and capacity constraints could place a high demand on available airline seats, pushing up fares, and making New England a more expensive place to conduct business, as well as decreasing its attractiveness to new or expanding businesses. Additionally, New England's mix of industries are relatively travel-intensive. Financial services, research and development firms, education institutions, and business services such as consulting, are all heavy users of air transportation.

Five sizeable commercial airports – Bradley in Hartford, Connecticut; Manchester; T.F. Green near Providence, Rhode Island; Portland, Maine; and Worcester, Massachusetts – lie within one hundred miles of Boston. Additionally, Hanscom Field, a general aviation airport and Air Force base with runways equipped to handle passenger jets, is located within 15 miles of downtown Boston (see Figure 7-2). In 1997, these airports were operating at just 50% of their capacity, and most could absorb a sizeable portion of the traffic flowing through Logan [172]. Virtually every regional transportation study has recommended that New England aviation and transportation planners view the region's largest airports as components of a single system. However, there are significant challenges to integration of the airports, among which are:

- Lack of demonstrated success in other regions and countries in managing an inventory of regional airports as a single, cohesive entity for *domestic* service. There are successful implementations of regional airport systems involving international and domestic flights being segregated to different airports such as in Japan, Korea, and in some European countries
- The completion of Boston's Central Artery project, the I-90 extension to Logan Airport under the Boston Harbor, and \$4 billion on-airport capital improvement investments by Massport, the operator of the Logan, will dramatically improve ground access to the facility. A mixed

message is effectively being sent to air travelers by encouraging the use of alternate airports to Logan while concurrently improving the ground access to Logan

- In the past, the regional airports have historically based their growth plans on competing with Logan Airport, and have traditionally harbored some political distrust of Massport intentions. These behaviors create institutional barriers to developing an atmosphere of cooperation between the regional airports
- Regional airports, especially Manchester and Worcester, have poor or inconvenient ground access from the Greater Boston area
- The network effect of airlines is strong as it is expensive for airlines to operate in all regional markets at the frequencies demanded by its business passengers and the prices demanded by the leisure market
- The regional airports also experience neighborhood opposition to capacity and traffic expansion. Additionally, T.F. Green has similar space constraints as Logan as it is surrounded closely by both water and residential neighborhoods

Despite the challenges, there has been significant traffic growth at many of the regional airports, as shown in Table 7-8. Manchester and T.F. Green have invested over \$300 million in terminal and airside improvements, and more importantly, Southwest Airlines moved into T.F. Green and Manchester in 1996 and 1999 respectively, more than doubling the passenger traffic at each airport. The regional airports have experienced enough growth that Massport has downwardly adjusted its growth projections for Logan Airport. Instead of expecting 37.5 million annual passengers in 2010, Massport now forecasts only 34 million [173].

Airport	1995	1999	Percent Change	1999 Percent of Total
	Passengers (millions)	Passengers (millions)		
Worcester, MA	0.07	0.05	(29%)	0.1%
Bangor, ME	0.42	0.42	0%	1.0%
Burlington, VT	0.85	0.87	2%	2.0%
Portland, ME	1.00	1.37	37%	3.2%
Manchester, NH	0.89	2.83	218%	6.5%
T.F. Green (Providence, RI)	2.00	5.15	158%	11.8%
Bradley (Hartford, CT)	5.00	5.75	15%	13.2%
<u>Logan</u>	<u>24.75</u>	<u>27.05</u>	<u>9%</u>	<u>62.2%</u>
Total	34.98	43.49	24%	100.0%

Adapted from: www.massport.com and Campbell, 1997

Table 7-8: New England Regional Airport Passenger Growth 1995-1999

Nevertheless, it is misleading to interpret regional airport passenger growth as just attracting passengers away from Logan airport, but instead more realistic to assume that it is also putting more people on airlines who normally would not have flown. As an illustration, Logan traffic still

grew 9% between 1995 and 1999. Even with the downward projections, Logan Airport still faces serious capacity constraints on its ability to effectively serve the region's future air transportation needs. Table 7-9 summarizes several transportation infrastructure investment alternatives for New England to consider in addressing its airport capacity issues.

Select Transportation Investment Options for New England's Airport System

1. Construction of a new unidirectional runway at Logan Airport to improve capacity by giving the ability to segment regional jets and turboprops from the larger passenger jets during departures under certain airport operating configurations
2. Further infrastructure expansion at regional airports such as Worcester, Manchester, and Hanscom. Worcester and Manchester will need significant investment in road infrastructure for ground access if they hope to capture more Logan traffic, while Hanscom will require investment in baggage systems, terminals, and gates
3. Incentives to shift a greater share of domestic passengers to regional airports, focusing on international service and long-haul service out of Logan. This will likely require: (1) investments in incentives to both passengers and airlines to result in desired behavior; and (2) investment in technology infrastructure to enable operational coordination and information dissemination
4. Invest in an improved network of regional express bus feeders from the Boston metropolitan area to the regional airports. This will require additional parking infrastructure at the park-and-fly lots, which are currently capacity constrained
5. Invest in improved high-speed ground transportation within the Northeast Corridor. Although Amtrak introduced its 150 mph service Acela service between Boston and New York in 2000, it is projected only to divert 1.2 million air passengers by 2010 [174], representing diverted traffic equivalent to only one-year of annual growth at Logan Airport. However, a recent USDOT study has estimated that investment in "TGV" quality (200 mph) high-speed rail service with 2 hour travel times and hourly frequencies of between four to six per hour to New York City could divert approximately 20% of all air trips. Investment in even more rapid mag-lev rail technology could result in air diversions to rail on the order of 25% - 27% [175]
6. Improve intermodal air-rail connections. The Northeast Corridor and Amtrak's Acela line is located only a few hundred yards from the T.F. Green terminal. A high-speed rail stop at the airport could improve the convenience of the Providence airport for many more Greater Boston residents. Commuter rail extensions or connectors to the Boston-Providence and Boston-Worcester lines could also improve the capture rates of the regional airports
7. Construct a second airport in the Greater Boston area. Although currently a political near impossibility, future growth rates may require a revisiting of this option

Table 7-9: Transportation Investment Options for New England Air Transportation

This section has presented three broad transportation issues facing the New England region and a listing of twenty different infrastructure “solutions” in which the region could choose to invest. Obviously, in a fiscally resource constrained environment, it is impossible to invest in all desired projects. Additionally, municipal boundaries make it difficult for a regional investment to gain necessary political and funding support, and institutional barriers prevent cooperative efforts between agencies and organizations across the six states. A regional competitive advantage framework, as was presented in Chapter 6, could provide a helpful context in which to evaluate and prioritize the aforementioned infrastructure investments for New England.

Introduction to the New England Cluster Assessment

In order to evaluate the regional infrastructure investments, it is first necessary to understand the needs specific to the region’s clusters, the source of New England’s competitive advantage. The next section explores the cluster initiatives conducted within the region in an attempt to look for useful cross-cutting transportation infrastructure investments. The framework presented in Chapter 6 will be used in order to (1) assist in understanding New England’s cluster transportation needs; and (2) evaluate the usefulness of the framework. Because a cluster initiative has not yet been undertaken for the entire region, the assessment is forced to rely on a state-by-state survey of cluster initiatives. The weaknesses of this approach will be critiqued in Section 7.8. Note that Maine and Vermont were excluded from the review due to their highly rural nature and the absence of a cluster initiative for each state.

For each state, the following items will be addressed:

1. Identification of the motivation for the cluster initiative
2. Description of the cluster initiative and the initiative leadership structure
3. A review of the inventory of clusters; assessing their stage of development and the approach the state is taking to develop or grow them
4. Determining if the initiative identified any specific or general transportation infrastructure needs for the clusters
5. Investigation of how the economic development plans are linked to the state transportation plans and the degree to which identified cluster transportation needs are included

7.4 Rhode Island

7.4.1 Motivation for Cluster Initiative

The motivations to evaluate Rhode Island's clusters resulted from a combination of factors. First, the Rhode Island economy had performed poorly in the first half of the 1990s, and the state was experiencing a large population loss and a resulting shortage of skilled labor. Second, key economic indicators such as number of jobs and per-capita-income were below their mid-1980s peak. Third, more Rhode Island residents were commuting out-of-state for work than were employed in total key industries such as jewelry manufacturing and textiles. Total out-of-state employment rose from 1.8% in 1979 to 6.1% in 1995 [176]. Finally, the state was experiencing a significant loss in manufacturing jobs to other regions of the country, especially the U.S. South. In the mid-1990s, the Governor created the Rhode Island Economic Policy Council to examine the competitive position of the state's industry clusters.

7.4.2 Cluster Initiative and Leadership Structure

Primary responsibility for Rhode Island cluster policy is divided between two organizations: the Rhode Island Economic Policy Council, responsible for the economic analysis and policy recommendations; and the Rhode Island Economic Development Corporation, operationally responsible for assisting cluster-specific industries with their business and policy needs. The two organizations are summarized below:

Rhode Island Economic Development Corporation (RIEDC): A non-profit public-private partnership, providing firms access to Rhode Island's economic development services. The organization's primary responsibility is to assist in the growth and expansion of existing Rhode Island firms and attract new businesses and investment to the state. RIEDC has specialists in each Industry Cluster providing policy and operational assistance to firms within the cluster.

Rhode Island Economic Policy Council (RIEPC): A non-profit corporation funded equally by the private sector and the State of Rhode Island. The Council is composed of members from the business, labor, higher education, and government sectors⁵. RIEPC provides an analysis of the strengths and weaknesses of the Rhode Island economy, and advise the State Legislature and Office of the Governor regarding state economic development policy.

In 1996, the Governor directed the RIEPC to identify and characterize the leading clusters within the state. The Council mobilized the economic infrastructure stakeholders of the state, with the notable absence of transportation planning and service stakeholders, and together identified nine industry clusters within Rhode Island along with nine recommendations to promote their growth. The RIEPC recommendations were presented to the State General Assembly which incorporated them into 1997 legislation of seven strategic initiatives for guiding the state agencies responsible for economic development. Accordingly, the 1998 Economic Development Plan for Rhode Island incorporates several of the recommendations within its overall goals and objectives for the state.

7.4.3 State Cluster Inventory and Needs Assessment

1996 RIEPC Cluster Study: Meeting the Challenge of the New Economy

The initial 1996 study undertaken by the RIEPC identified the state clusters by SIC code and ranked according to a multi-criteria method, including the number of jobs, sales generated by the industries, and the location quotient of the agglomeration of industries. The analysis resulted in the identification of the following nine clusters:

1. *Jewelry Manufacturing:* Rhode Island is the center of U.S. Jewelry manufacturing, employing 25% of the U.S. workforce [177]. Other industries located within the state directly support the jewelry industry, including metal plating, casting, machine tools, and plastics. Although employment in the sector has been declining over the past fifteen years, exports have remained stable due to improved productivity. Most of the exports are domestic, rather than international, though. Despite having all the components of a working cluster, it appears in fact to be a low-performing, or latent, cluster. Jewelry firms are relatively closed and cooperation is extremely limited. The needs assessment focused on the creation of a trade organization to both promote marketing efforts and information sharing among the cluster firms. No mention was made of specific transportation needs for this cluster.
2. *Precision Metalworking:* The cluster included manufacturers which produced small or intricate components designed to high tolerances. The majority of the Rhode Island firms provided services on a contract basis, selling its services and components to other manufacturers rather than selling products directly to Original Equipment Manufacturers (OEMs) or customers. The industry is able to charge a price premium for quick turnaround time on design and fabrication, and with 29% of the firms exporting outside the region [178], an efficient transportation system would be beneficial. The study concluded that this group of firms did not constitute a working or latent cluster due to the lack of interaction caused by high level of competition between firms and the lack of a

⁵ No transportation planning or service representatives sit on the Council

vertically integrated network of suppliers and producers. No mention was made of specific transportation needs for this cluster.

3. *Boat Building and Marinas:* Rhode Island companies have a long history of boat building, including the pioneering of fiberglass boat production processes in the mid-1950s. The cluster is composed of approximately 35 companies and has a niche in the small sailboat market, with approximately 30%-40% market share [179]. Over all, the small industry does not appear to represent a working or latent cluster, but is regarded as a potential cluster if it can attract boat component manufacturers (marine electronics and motors) to the state.
4. *Seafood Products:* The industry includes fisheries, processors, and wholesalers. The industry is vertically integrated, but the small size of the industry did not allow classification as a working or latent cluster. Transportation infrastructure investment was cited in the needs assessment including improvements to state-owned ports, due to existing conditions of poorly maintained road surfaces and dilapidated docks. Additionally, the lack of cold storage facilities in the state cause the industry to ship their products out of the state for storage adding additional transportation costs.
5. *Electronics and Instruments:* This cluster represented a diverse number of industries tied together through their use of precision electronics. Limited buyer-supplier linkages precluded cluster classification as working or latent. In the needs assessment, improved transportation infrastructure was not specifically cited. However, a major concern to the cluster team was that most of the industry had little to no linkage to Boston's Route 128 electronics cluster which is located only one hour away. Transportation infrastructure was not seen as playing a limiting role in the lack of linkages, but the proximity of Boston's cluster was seen as a potential competitive advantage that should be exploited.
6. *Financial Services:* The concentration of commercial banking, insurance companies, and financial offices in Rhode Island were similar to national averages, and therefore not technically a competitive cluster. However, citing the recent expansion of several Boston financial service firms into Providence, the cluster had the potential to serve as a satellite for Boston in the financial services area. No specific transportation infrastructure needs were mentioned in the assessment.
7. *Software:* As a small component of Rhode Island's industries, with a Location Quotient (LQ) below 1, this sector did not qualify as a cluster. However, like the financial services sector, the proximity to Boston was seen as a competitive advantage which could be used to grow the cluster. In the assessment, the report specifically cited the need to attract qualified software professionals to the state, and recommended the improvement of transportation links between Providence and Boston as a means to this end. Specifically, the report proposed improving the frequency of commuter rail service between the cities as a way to develop links to Boston's software cluster and in attracting two-career couples.
8. *Biomedical:* Similar to the Software sector, the industries do not represent a cluster, but their proximity to Boston represent a potential opportunity for linkages and growth. No mention was made of specific transportation needs for this potential cluster.
9. *Travel and Tourism:* Tourism was determined unlikely ever to contribute economic growth for the Rhode Island economy in the way that it does for Florida and California.

However, recent investment in T.F. Green specifically contributed to the growth in this sector.

The overall recommendations of the cluster study argued against large capital infrastructure spending or tax subsidies for job creation, and instead advocated state policies encouraging and enabling firms to make institutional changes needed to become more competitive.

General Assembly Legislation

Based on the RIEPC cluster study, seven strategic economic development initiatives were enacted by the State General Assembly. Two initiatives were relevant specifically to clusters and transportation infrastructure:

1. Initiative to Strengthening Global Connections

- a. Strategy: increase region's international air capacity by integrating region's air and rail passenger transportation systems; build a trunk-line connection to the new global logistics grid, specifically the Suez and NAFTA Corridors
- b. Project: Improvements to T.F. Green Airport; intermodal airport train station; increase and extend commuter rail; invest in container port at Quonset Point
- c. Expected Results: shift air trips to high speed rail; shift domestic flights to Providence and Manchester; decrease in cost of goods sold

2. Develop Industry Clusters

- a. Strategy: Position Rhode Island as high value location in Boston metropolitan area; nurture and expand existing base of industries [180]

Rhode Island Economic Development Plan Goals and Objectives

The State Economic Development Plan is published by the State Planning Council, and is intended as a basic guide for economic development of the state. The strategic initiatives enacted by the General Assembly are incorporated within the guide. The State Planning Council has been designated as the single statewide MPO for transportation planning and is also responsible for creating the transportation plans for the state. This integrated structure of economic development and transportation planning is well represented in the Economic Development Plan. The Plan puts forth three guiding objectives and goals, each of which make specific reference to transportation infrastructure investment as summarized in Table 7-10 as follows:

Objective 1 - Jobs: Provide at least 24,000 new employment opportunities for Rhode Island residents by the year 2020. Recommendation of nine specific policies, including:

- Promote and develop the use of mass transit in order to eliminate spatial barriers to employment opportunities. Encourage development in densities high enough to facilitate the economical provision of mass transit.

Objective B – Facilities: Work with economic development practitioners to encourage industrial development that advances the long-term economic well-being of the state. Recommendation of 16 specific policies, including:

- Ensure adequate investment to maintain and improve a balanced, intermodal transportation system that meets the needs of the state's commerce and labor force. Maintain shipping channels and recognize the economic potential of T.F. Green airport.
- Contribute to the stabilization and redevelopment of central business districts through the provision of supporting services such as transportation access.

Objective C – Business Climate: Maintain a business environment conducive to the sustenance and growth of suitable industry and climate. Recommendation of 14 specific policies including:

- Maintain public infrastructure. Provide additional transportation infrastructure where it is clearly demonstrated as necessary and in a manner that will protect the long-term health of the state's fiscal resources.

Adapted from: Rhode Island State Planning Council, 2000.

Table 7-10: Economic Development Goals and Objectives for Rhode Island

7.4.4 Integration with Transportation Planning

The State Planning Council has a Transportation Advisory Committee responsible for developing the short- and long-range transportation planning documents, and works cooperatively with the Rhode Island Department of Transportation (RIDOT), Rhode Island Public Transit Authority (RIPTA), and the Rhode Island Airport Corporation. Given that the State Planning Council is responsible for the statewide economic development goals, it is not surprising that they should be represented to some degree within the Regional Transportation Plan. Two of the four goals for the plan directly relate to economic development: (1) use transportation to support economic development, with good access to employment being particularly important; and (2) continue to integrate the planning process for all aspects of the state's development process across functional and jurisdictional lines [181].

Additionally, three prominent approved projects within the RTP directly reflect the objectives established in the Economic Development Plan: (1) develop transportation models to implement

welfare-to-work goals; (2) study an Interstate ramp system to support full development of the proposed Quonset Point port; and (3) develop the Warwick Intermodal Rail Station, supporting the adjacent business district and connecting to T.F. Green Airport [182].

Figure 7-4 traces the flow from cluster study to the regional transportation plan for Rhode Island:

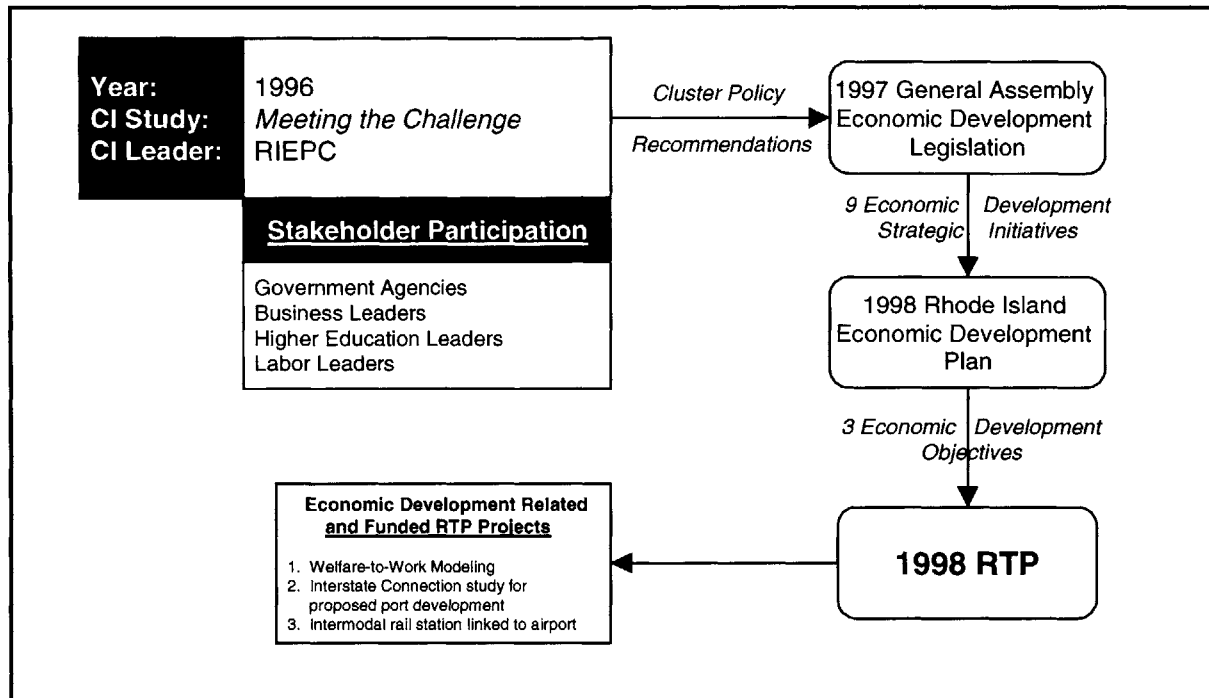


Figure 7-4: Rhode Island Cluster Study and Transportation Planning

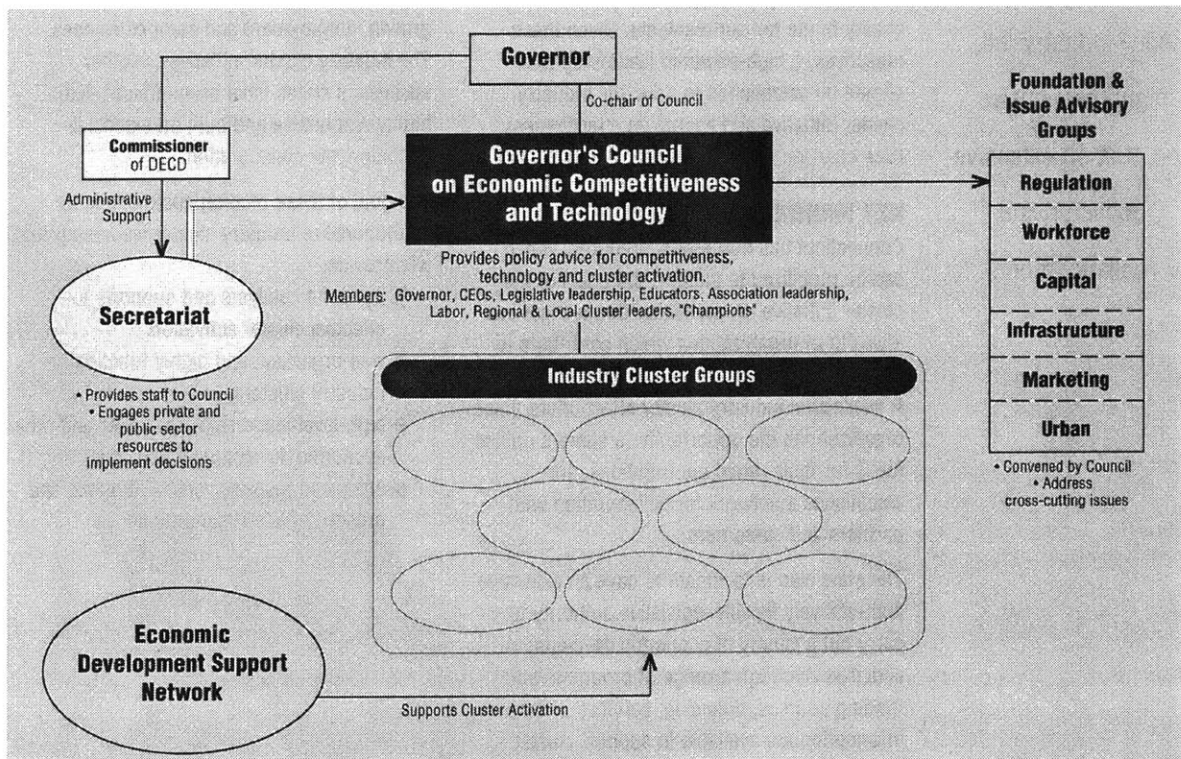
7.5 Connecticut

7.5.1 Motivation for Cluster Initiative

In 1996 the Connecticut State Legislature passed an Act calling upon the Connecticut Department of Economic and Community Development (DECD) to move forward with industry cluster development. Several factors within the state economy prompted the Legislature to pass such a measure: (1) a skilled labor shortage; (2) limited population growth; (3) aging physical infrastructure; (4) lower rate of start-up companies than the rest of the nation; and (5) several national surveys finding the state's "business friendly" image lacking [183].

7.5.2 Cluster Initiative and Leadership Structure

Under orders from the State Legislature, the DECD created the Industry Cluster Division within the department. In 1997, the DECD and the Governor mobilized senior executives from state industries and government organizations to form five advisory boards and undertake a cluster study, with the first task to identify the state's primary industries and assess their competitive needs. The outcome of this mobilization stage was a 1998 task force of 125 business leaders in Connecticut assembled to study the best method of implementing cluster-based development in the state. The task force's research identified seven industry clusters critical to Connecticut's economic competitiveness and led to legislation passed in 1998, called the "Cluster Bill," which officially launched the Connecticut Industry Cluster Initiative under the DECD. The organizational structure created for the Initiative is shown in Figure 7-5:



Source: Connecticut Industry Cluster Advisory Board, 1998.

Figure 7-5: Connecticut Cluster Initiative Organizational Structure

One of the most important accomplishments of the legislation was the establishment of the Governor's Council on Economic Competitiveness and Technology, comprised of a cross-section of leaders from industry, education, labor, the state legislature, and industry organizations. The Council meets each quarter to monitor the cluster initiative progress and discusses ways to further

enhance and support it. While no transportation planning and service representatives sit on the Governor's Council, they are well-represented in the Infrastructure Issue Advisory Group which subsequently has evolved into the Transportation Infrastructure Issue Advisory Board. Continuing work by the Cluster Industry Initiative program led to a second "Cluster Bill" passed in 1999 further endorsing cluster-based economic development and initiating a research and development tax credit, among other cluster-friendly tax and funding issues. In 2000, the Governor's Council sponsored a Connecticut Transportation Summit which resulted in the creation of a new statewide Transportation Strategy Board responsible for developing long-range transportation plans consistent with the Cluster Initiative's objectives.

7.5.3 State Cluster Inventory and Needs Assessment

The 1998 task force identified each cluster based strictly on their industry LQ, comparing the concentration of a Connecticut industry, using SIC codes, with the national concentration. A LQ of greater than one was used as the criteria for classifying an industry group as a cluster. Based on the task forces definitions and descriptions contained within their final report [184], the inventory of clusters and their development stages can be summarized as follows:

CLUSTER	<u>Cluster Development Stage</u>		
	Working	Latent	Potential
Financial Services	X		
Biosciences		X	
Aerospace Components Manufacturing			X
Software/Information Technology			X
Metals Manufacturing			X
Marine Industry			X
Plastics			X

Table 7-11: Connecticut's Cluster Inventory

It is interesting to note the aggregated level of cluster detail even though the agglomeration of insurance-related firms in Hartford, Connecticut is one of the most documented examples of a working cluster. Still, it falls under the general category of financial services, which in this case also includes the concentration of financial firms near New York particularly in the city of Stamford.

The state's Cluster Initiative relies on what is termed "Cluster Activation" whereby companies in related industries come together and request formal recognition as an organized industry cluster, similar to the method employed in Tucson, Arizona, described in Section 5.3.1. The state relies on corporate leaders to initiate the cluster activation and drive the cluster activities, while the public sector role is more of facilitator and policy analysis. In general, the Cluster Initiative is not expecting transportation infrastructure to improve the competitive advantage of its industries. Instead, the policies and programs are focused more towards workforce development, tax credits, marketing, and inter-firm organizations. Even so, the attention received and the role assumed by transportation infrastructure investment over the past five years in Connecticut has far surpassed any other New England Cluster Initiative.

In the initial cluster transportation needs assessment performed by the initiative's Transportation Infrastructure Advisory Board the role transportation infrastructure plays in the competitiveness of the clusters was recognized and recommendations focused on five issues needing immediate attention [185]:

1. Reducing congestion on I-95 during peak commuting periods by:
 - Increased use of the MetroNorth commuter rail service
 - Improved transit and shuttle connections, and demand-responsive jitney service
2. Assure that Connecticut receives the full benefit of the Northeast Corridor high-speed rail service by improving interstate rail and bus connections, as well as expanded parking at key stations. Currently the Acela Express stops only in New Haven
3. Enhancing the accessibility of southern Connecticut's airports
4. Provide transportation services enabling former welfare recipients to gain access to jobs and job-training (Welfare-to-Work)
5. Enhance the competitiveness of Bradley Airport relative to other regional airports by convening an advisory board to review all aspects of the airport's operations to determine what steps, if any, could be taken to improve the competitive situation.

Most significant was the second round of transportation needs assessments conducted during the 2000 Connecticut Transportation Summit. The summit found that the state lacked a single entity with the authority and accountability to establish, monitor, and implement a comprehensive, statewide transportation strategy which would enhance Connecticut's competitive position and quality of life for its residents. In response, the Governor's Council created the Transportation Strategy Board entity, to be established by legislative statute in June 2001 and composed of

fifteen business, legislative, and transportation agency executives. The Board will be responsible for developing long-range transportation plans which adhere to the following guiding principles [186]:

- Explore the transportation network connectivity of Connecticut to New England economies
- Engage both MPOs and other regional planning organizations in developing the strategy
- Develop the appropriate metrics, methodologies, and standards for determining cluster needs
- Play a leadership role with other Northeastern states and eastern Canadian provinces in advocating and developing a transportation strategy for the entire Northeast region

7.5.4 Integration with Transportation Planning

Overall, the 2001 Connecticut STP addresses or recognizes most of the transportation investments found in the cluster needs assessment, including investment in Bradley Airport, connectivity to the Northeast Corridor, Paratransit, and Welfare-to-Work programs. The STP is prepared jointly by the Connecticut Department of Transportation and the DECD. Furthermore, the STP summarizes the findings of the Connecticut Transportation Summit 2000, and explicitly recognizes that the plan must be cognizant of the cluster-based economic development initiatives being undertaken by the state. Figure 7-6 traces the flow from cluster study to the statewide transportation plan for Connecticut:

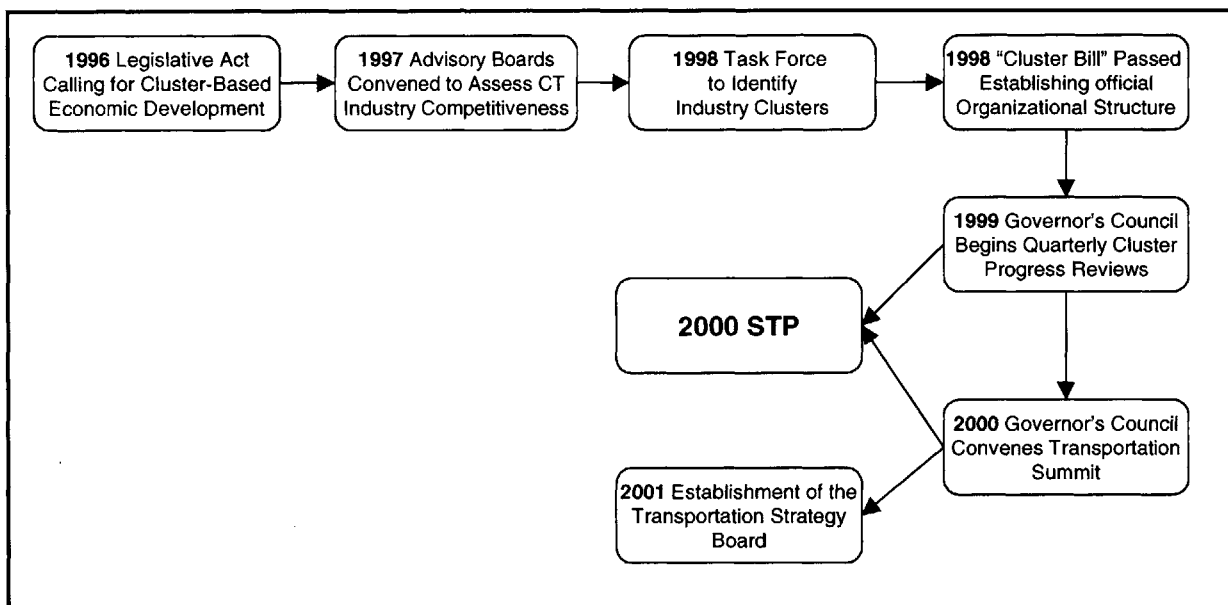


Figure 7-6: Connecticut Cluster Initiatives and Transportation Planning

7.6 Massachusetts

7.6.1 Motivation for Cluster Initiative

The cluster studies performed in Massachusetts were some of the first to appear in the nation, due in large part to Michael Porter's academic position at Harvard University while developing his theories on competitive advantage and industry clustering. In the late-1980s and early-1990s, the Massachusetts economy was in the midst of a serious economic downturn with per-capita income growth and employment levels in 1989 and 1990, below national averages. The cause of this downturn was being attributed to multiple explanations: the high cost of living and doing business in the region, the loss of high-technology leadership to California, cuts in defense spending, and so forth. Before Porter's cluster study, most of the assessments of the Massachusetts economy were broad and aggregated. Porter was motivated to look at both the historical performance of the state, and the historical and current performance of the states core clusters and other industries.

7.6.2 Cluster Initiative and Leadership Structure

The first cluster study was an independent report completed by Michael Porter for the Office of the Secretary of State in 1991, entitled *The Competitive Advantage of Massachusetts* in which four core industry clusters were identified. In 1992, the Challenge for Leadership, an initiative in the early 1990s that brought together Massachusetts government, business, labor, civic, and religious leaders to address pressing state challenges, chose economic development as the theme of its annual conference. Monitor Company, Harvard University, and Michael Porter authored a pro bono study, entitled *Toward a Shared Economic Vision for Massachusetts*, building upon the earlier report. The aim of the study was to lay the foundation for a long-term economic vision for Massachusetts. Governor Weld called for the preparation of an economic strategy for the state as part of his administration's priority of improving the economic climate of the state. In 1993, Executive Office of Economic Affairs (EOEA) led the effort to create an economic blueprint which would serve as guidance for how the Massachusetts state government could partner business, labor, research, and academic communities to foster an environment of innovation. The EOEA, partnered with the University of Massachusetts, first hosted a series of focus sessions with representatives from every region of the state to assess the economic development needs. Relying heavily upon Porter's work, regional planning agencies' economic development plans, and the Metropolitan Plan for Greater Boston, an overarching strategy was created citing twelve categories of action which described specific actions for state government to promote and support

the implementation of the economic vision. The recommendations by the EOEa were reviewed by key policy makers, including the Massachusetts Bay Transportation Authority, the Massachusetts Highway Department, and Massport. The plan was officially adopted in 1994 as the Commonwealth's Strategic Economic Development Plan and in 2001 still acted as the primary guiding document for the Department of Economic Development, formerly the EOEa.

More recently, in the mid- and late-1990s, the Massachusetts Technology Collaborative (MTC) had assumed a strong leadership role in cluster-based activities. The public-private partnership was formed in 1994 and has taken responsibility for many of the clusters including non-technology industries. Annually, the organization publishes the *Index of the Massachusetts Innovation Economy* looking at factors contributing to or hindering economic growth, similar to the *Index for Silicon Valley* published by JVSv.

7.6.3 State Cluster Inventory and Needs Assessment

Porter's first cluster inventory in 1991 identified four core clusters in Massachusetts: health care, information technology, financial services, and knowledge creation services. At the time of Porter's study, these four clusters represented 35% of the total Massachusetts employment [187]. Porter also identified three other clusters, environmental services, plastics, and metalworking, but concluded that these were not core, or working clusters. To identify the clusters, Porter analyzed the SIC data looking for industry concentrations, but supplemented this analysis with dozens of detailed field interviews and analysis of the exports of each industry to measure the extent to which they exported their products and services beyond the local economy. Furthermore, he listed key companies in each cluster adding to the level of detail in his analysis which included 74 health services firms, 56 knowledge-creation enterprises, 57 financial services firms, and 30 information technology companies [188]. An analysis of the factor conditions of each core cluster resulted in no explicit recommendation of specialized transportation needs for any given cluster. However, based upon the four clusters shared needs, Porter went on to make ten broad recommendations about improving the competitiveness of the core industries. The sixth recommendation, "Infrastructure for the Year 2000," made the following recommendations as a component of its overall assessment of infrastructure needs:

1. "The Central Artery project will help with [reducing] congestion in reaching Logan Airport"

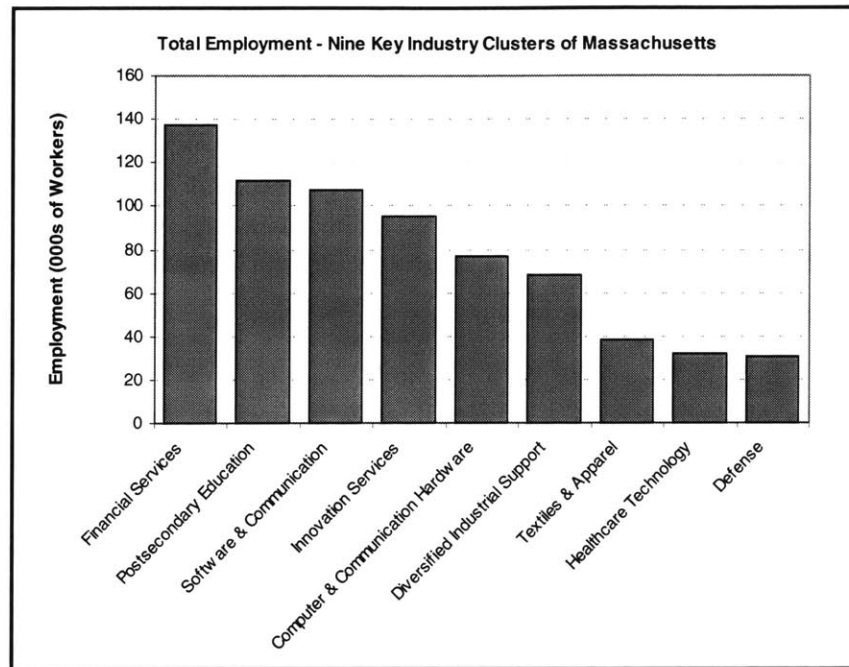
2. “Advanced transportation capability will be needed to better connect the region to the rest of the world and promote trade. Better direct international air service, a second Boston airport, and removal of highway bottlenecks merit more detailed study [189]”

In the follow-up study by Porter in 1992, the four core clusters were maintained, and transportation infrastructure was neither explicitly listed as a strength contributing to the economy, or a weakness. The high-cost of doing business was cited as a weakness, and transportation costs were considered. The conclusion of the second study resulted in the definition of ten needs for Massachusetts which would contribute to economic development, one of which was additional infrastructure, with Porter arguing “the Commonwealth needs the transportation infrastructure necessary to compete in the global economy [190].”

The 1994 Strategic Economic Development Plan with its twelve broad categories of action, listed “Infrastructure Investment for Economic Growth” as one of the action items. The category explicitly identified the following transportation investments as desirable:

1. Central Artery Project (the “Big Dig”)
2. Northeast Corridor High-Speed Rail
3. Logan Airport Modernization
4. Expanded Commuter Rail Service
5. Raising bridge clearances to support doublestacking of freight cargo

Presently, the MTC identifies nine key industries, shown in Figure 7-7. Using SIC code data, the MTC analyzes and ranks Massachusetts industries based on a multicriteria rating which includes employment concentration in the state relative to that of the nation, employment share as a share of total state employment, annual growth rates, and absolute number of establishments. The MTC also publishes an annual index of thirty indicators of the innovation process and benchmarks them against similar measurements from leading competitor states. None of the thirty indicators have a direct connection to transportation infrastructure performance, unlike the *Index of Silicon Valley* which includes four indices related to transportation performance (see Section 5.1.1 for details).



Source: Massachusetts Technology Collaborative, 2000.

Figure 7-7: Nine Key Industry Clusters of Massachusetts - 1999

7.6.4 Integration with Transportation Planning

In Massachusetts, regional organizations play an important role in the development and implementation of transportation plans and programs. All cities and towns are represented by one of thirteen comprehensive Regional Planning Agencies (RPAs). Local elected officials, or their designees, from member communities serve on a commission that oversees the policies, programs, and operations of the RPA. The RPAs provide regional coordination services regarding a variety of comprehensive planning issues such as transportation, land use, zoning, and so forth.

Massachusetts also has fifteen Regional Transit Authorities (RTAs) that provide public transportation services in their designated service areas. In general, Massachusetts RTAs are independent public authorities. Local elected officials, or their designees, from each of the communities in the RTA service area serve on a Board that oversees the RTA's policies, programs, and operations. In general, the RTAs are precluded by state legislation from directly operating any transportation services; instead, they contract with private providers for all fixed route, demand responsive, and paratransit services.

The RPAs and RTAs play an important role in the development and implementation of transportation policies, plans, and programs through their membership in the Commonwealth's Metropolitan Planning Organizations (MPOs). The MPOs are charged with conducting the continuing, cooperative, and comprehensive metropolitan transportation process, as defined by ISTEA and TEA-21 in the development of regional transportation plans and programs.

Massachusetts' MPOs are comprised, at a minimum, of four agencies: Executive Office of Transportation and Construction, the lead transportation policy agency; the RPA, representing regional and local interests; Massachusetts Highway Department, the primary highway transportation provider; and the RTA, the regional public transportation provider.

Given that Massachusetts has one of the earliest cluster studies and adoption of cluster-based economic development planning, the 1997 Boston Regional Transportation Plan was examined to see what elements of the cluster-based economic development policy, if any, were incorporated. Regarding prioritizing investment projects, the RTP established nine criteria including "Change in Productivity," an important measure for competitive advantage. However, the projects were never specifically quantified by this criteria. The RTP also provided fourteen key policies which would guide the investment decisions. The seventh policy was to "stimulate and sustain regional economic development through timely transportation investments [191]." The policy went on to recognize the statewide economic strategy plan adopted by the EOEA in 1994 and took responsibility with the recommendation in that plan to work closely with economic development organizations. Beyond this brief paragraph in the RTP recognizing the cluster-based economic strategy, the projects in the RTP were never directly linked to the economic strategy's recommendations.

The cluster study chronology and its link to Massachusetts transportation planning in Figure 7-8. The dotted lines between the 1994 Economic Development Plan and the transportation plans represent the fact that cluster-based development is nominally represented in each.

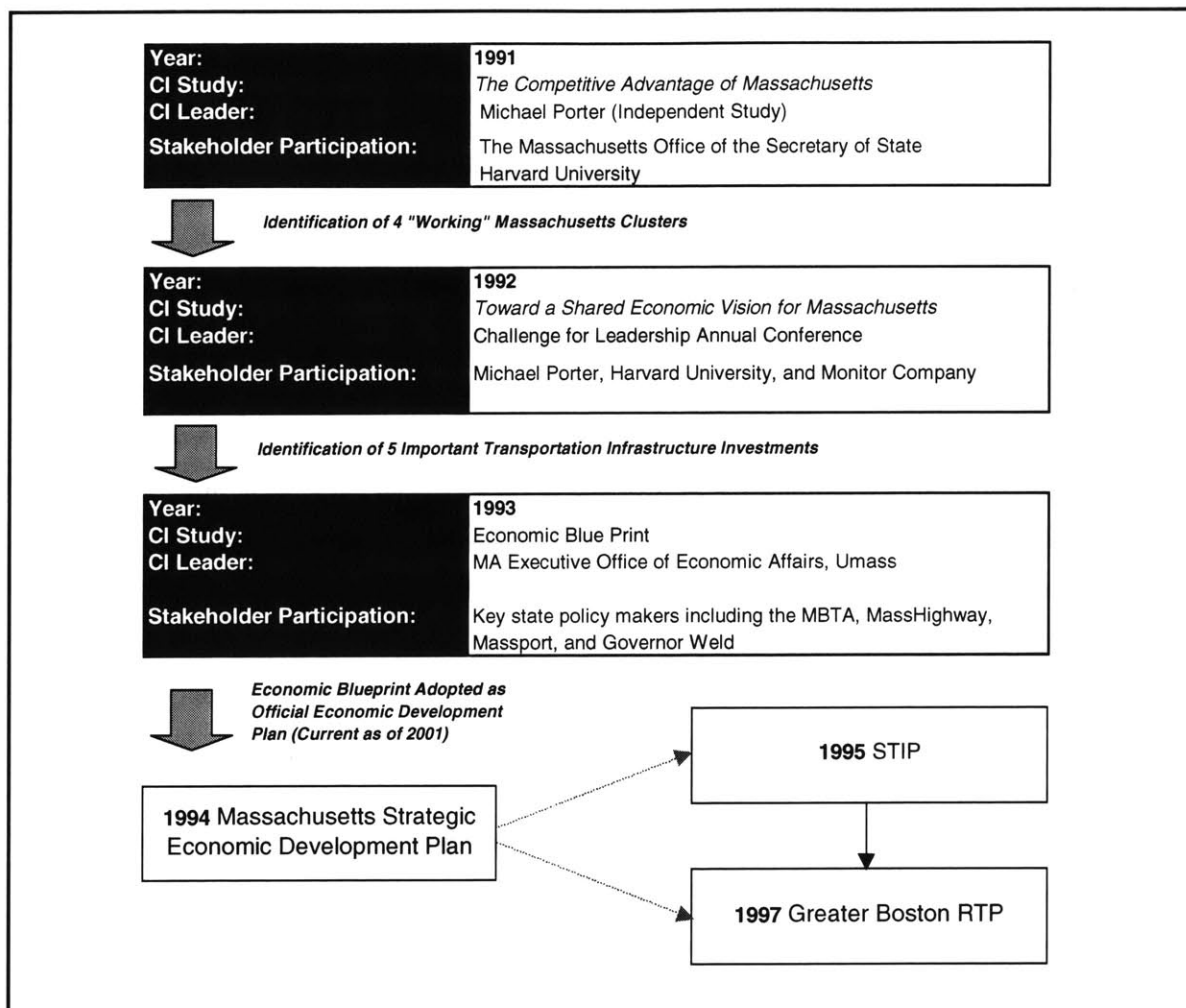


Figure 7-8: Massachusetts Cluster Initiatives and Transportation Planning

7.7 New Hampshire

7.7.1 Motivation for Cluster Initiative

In 1992, New Hampshire's economy had undergone significant changes since the mid-1970s, moving from a focus in textiles and leather products to more industrial and electronic component manufacturing. At the same time, the state government was moving from an industrial policy of indifference to one of moderate activism, and the state economy, which first benefited from Department of Defense expenditures, began to suffer from their cutbacks in the early nineties. The initial cluster initiative was really not a true initiative, but a research exercise by university researchers whose goals were to (1) test the application of Porter's theory of competitive

advantage within the context of New Hampshire, and (2) provide policy guidance to the state of New Hampshire.

7.7.2 Cluster Initiative and Leadership Structure

The cluster initiative was initially led by the New Hampshire Industry Group (NHIG) which spent two years identifying the principal, or leading, industries in New Hampshire which compete successfully in international markets, culminating in a 1994 published study entitled *Porter's Model for Geographic Competitive Advantage: The Case for New Hampshire*. The primary mission of the NHIG is to further the knowledge of industrial and economic competitiveness, and facilitate endeavors which advance the growth and development of New Hampshire. The NHIG is composed of professors and economists in the University of New Hampshire's school of business and economics. In 1998, the New Hampshire Office of State Planning published its bi-annual *State Development Plan* which presents a summary analysis of economic conditions for New Hampshire and proposes economic development initiatives to be undertaken by the state. The State Development Plan used the NHIG study as a basis for its industrial policy recommendations, focusing on policies beneficial to the leading industries found in the NHIG cluster study. In creating the State Development Plan, the Office of State Planning relies on the guidance of the Governor's Office, NHIG, the International Trade Resource Center (IRTC) which provides assistance to New Hampshire businesses with exports, and the Department of Resources and Economic Development.

7.7.3 State Cluster Inventory and Needs Assessment

The NHIG researchers relied on a composite analysis of U.S. Census of Manufacturers, SIC classifications, and a detailed survey sent out to 350 New Hampshire firms to determine which, if any clusters existed within the state. The resulting list of industries found to agglomerate within the state were (1) Machinery and Manufacturing, (2) Electronic Components, (3) Instruments Manufacturing, and (4) Fabricated Metal Products. These four leading industries made up 48% of the state's manufacturing employment and 81% of the manufacturing exports [192]. Although these four industries comprised a large concentration of employment, the NHIG researchers concluded they did not constitute "working" clusters as they were relatively widely scattered throughout the state, and reported little integration of supplier networks and trade organizations within the leading industries. Instead, many of the firms functioned as suppliers to OEMs outside the New England region. The clusters are more appropriately classified as "potential" clusters.

Before assessing the needs of the potential clusters, the cluster study considered the advantages of New Hampshire as related to these industries. The researchers determined that the access to the Boston market and research universities played an important role in the high-skill level of the leading industries' workforce. Furthermore, the two southeast counties, closest to Boston, had both the strongest local economies and the highest concentration of leading industries. The researchers also found that New Hampshire benefits from its high quality of life, the tax advantage of New Hampshire – the only state without a broad-based sales or personal income tax, and relatively low real estate and living costs compared to the Boston metropolitan region.

In assessing the needs of the New Hampshire clusters, the researchers did not make any recommendation regarding specialized transportation infrastructure required. The State Development Plan did cite air transportation as one of the keys to retaining and attracting “high-value-added industries,” but did not make any specific infrastructure investment proposals. Instead, the plan focuses on the need to maintain the state’s competitive tax policy and lower cost of living, recommending in general that the state rely on cost advantages to attract and grow businesses rather than relying on infrastructure investments. Given that the four leading industries of New Hampshire did not represent working clusters, the State Development Plan, recommended that the state follow a “homegrown” formation strategy where the state would specifically avoid picking “winning and losing” industries, and instead invest in general economic infrastructure and policies. The Plan recommended strongly that the state not target any particular industry, but instead focus on generic policies that could benefit all clusters.

7.7.4 Integration with Transportation Planning

The New Hampshire transportation planning and service organizations were not involved in the cluster studies, nor are the goals of the 1998 State Development Plan reflected in the 1998 Statewide Transportation Plan. The STP lists several criteria for evaluating and selecting transportation investments, but economic development is not one of them. Figure 7-9 summarizes the New Hampshire cluster initiatives, and highlights the absence of a connection between the economic development plans and the state transportation plan.

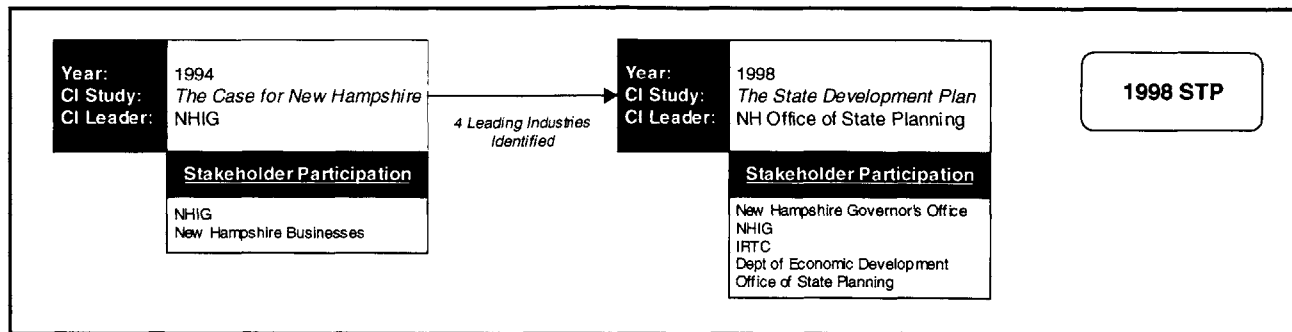


Figure 7-9: New Hampshire Cluster Studies and Transportation Planning

7.8 Assessment of the Extended Framework for New England

To examine the usefulness of the extended ReS/SITE framework, this section will assess New England using the cluster initiative architecture presented in Section 6.2, and evaluate the applicability of the cluster transportation needs assessment framework presented in Section 6.3. The section concludes with a critical examination of the methodology.

Mobilization Stage

Each of the four New England states initiated their cluster studies for essentially the same reasons. The economic infrastructure representatives were mobilized in the early- to mid-1990s to address solutions to the growing problems of population loss, shortage of skilled labor, declining economic indicators such as per-capita-income, defense industry cutbacks, and overall poor performance of the state economies. The earliest two studies, New Hampshire and Massachusetts, were initiated by academic institutions in the respective states. The later initiatives, Rhode Island and Connecticut, were by direct legislative order passed by the state legislatures. Although each state faced similar economic motivations, it is notable that no region-wide initiative was undertaken or considered. Instead, each cluster initiative was performed within the political boundaries of each individual state.

Cluster Leadership Structure

Table 7-12 lists the primary cluster study for the New England states and the organization which assumed the leading role in the cluster initiative. Only one state, Massachusetts, had an existing government agency responsible for economic development in the leadership role. Rhode Island and Connecticut were each led by a public-private partnership specifically created for the cluster initiative. New Hampshire's efforts were led by a pre-existing public-private partnership. Only

one initiative, Connecticut, included the involvement of transportation planning or service organizations, and as a result, had a much larger emphasis placed on transportation infrastructure within the initiative. While it is not surprising that transportation planning organizations did not assume a leadership role, they represent an important component of the economic infrastructure (as discussed in Section 2.5.3), and their absence implies a lack of institutional linkages between economic development and transportation planning in some of the states. The Connecticut Issue Advisory Board, with Transportation Infrastructure as one of the committees, provides an interesting model for the New England region of an organizational structure which permits the inclusion of the transportation representatives.

State	Yr	Primary Cluster Study	Leadership	Identified Cluster Transportation Needs	Transportation Planning Organization Involved in Study?
MA	92	<i>Toward a Shared Economic Vision for Massachusetts</i>	Executive Office of Economic Affairs	General Needs	NO
NH	94	<i>Geographic Competitive Advantage: The Case for New Hampshire</i>	New Hampshire Industry Group	None	NO
RI	96	<i>Meeting the Challenge of the New Economy</i>	Rhode Island Economic Policy Council	General and Specialized Needs	NO
CT	98	<i>Partnership for Growth</i>	Governor's Council on Economic Competitiveness and Technology	General Needs	YES – Advisory Role

Table 7-12: Summary of New England's Primary Cluster Studies

Cluster Inventory

Table 7-13 lists the inventory of New England clusters as identified in each of the primary cluster studies. The states identified a total of only six clusters which could be considered “working” clusters, and one “latent” cluster. The remaining 17 regional industries identified were not in fact examples of “true” clusters as defined in Chapter 2, rather they were industries selected because of their higher than average contribution to the states’ economies. It is interesting to note that Rhode Island, the region’s smallest state, identified the largest number of industry “clusters” on which to focus economic policy. Also, for each state, no explicit priorities were given to one cluster over the other, even though certain concentrations of industries contributed greater shares of the states’ economic output. The lack of clarity on which clusters would be promoted makes it difficult for transportation planning organizations to prioritize specialized transportation investment needed to promote specific cluster development or growth.

State	Cluster	Cluster Development Stage		
		Working	Latent	Potential
MA	<i>Health Care Technology</i>	✓		
	<i>Information Technology</i>	✓		
	<i>Financial Services</i>	✓		
	<i>Knowledge Creation Services</i>	✓		
NH	Machinery and Manufacturing			✓
	Electronics Components			✓
	Instruments Manufacturing			✓
	Fabricated Metal Products			✓
RI	<i>Jewelry Manufacturing</i>	✓		
	Precision Metalworking			✓
	Boat Building and Marinas			✓
	Seafood Products			✓
	Electronics and Instruments			✓
	Financial Services			✓
	Software			✓
	Biomedical			✓
	Travel and Tourism			✓
CT	<i>Financial Services</i>	✓		
	Biosciences		✓	
	Aerospace Components			✓
	Software and Information Technology			✓
	Metals Manufacturing			✓
	Marine Industry			✓
	Plastics			✓

Table 7-13: Inventory of New England's Clusters

Although six working clusters were identified through individual states' cluster studies, to assume that this inventory represent an accurate list of the New England region's clusters is incorrect. Each cluster study examined its industries within the constraints of its political borders. The inventory of clusters might have looked very different if economic regions were considered rather than state jurisdictional boundaries. The "potential" electronic component clusters of Rhode Island and New Hampshire may in fact be part of an overall larger, more dynamic "working" cluster also encompassing the Boston metropolitan region. Furthermore, when economic regions within New England are considered, industry clusters may emerge that were invisible when only individual state industries were considered. For evaluation of New England's regional transportation investments within the regional competitive advantage context, the cluster inventory presented in Table 7-13 is insufficient. A true regional assessment of New England's

competitive industry clusters is necessary, but based on the discussion in Section 7.2 regarding the lack of New England regional economic development organizations, it is unclear which group would take the leadership role in this initiative.

Cluster Needs Assessment

The framework for assessing the specialized needs of clusters presented in Figure 6-3 was constructed with the intention of prioritizing the effectiveness of transportation investments within ReS/SITE's multicriteria evaluation methodology. The identification of clusters at the state level presents at least two obstacles to the successful application of the needs assessment framework: (1) high-level aggregated cluster types, such as "health care technology," prevent planning organizations from categorizing specialized transportation needs, and (2) identification of general transportation needs for all state clusters rather than on a cluster-by-cluster basis. The identified transportation needs drawn from the statewide cluster studies are summarized in Table 7-14, along with their overlap with the three broad regional transportation issues presented in the beginning of the chapter.

State	Identified Cluster Transportation Need	Cluster Impacted	I-95 Congestion Relief	Intermodal Freight Competitiveness	Regional Airport System
MA	Central Artery project investment	General			
MA	Northeast Corridor High-Speed Rail investment	General	✓		✓
MA	Modernization of Logan Airport	General			✓
MA	Expanded commuter rail service	General	✓		
MA	Raise bridge clearances to support doublestacking of freight cargo	General		✓	
NH	--	--	--	--	--
RI	Upgrade state-owned ports	Seafood Products		✓	
RI	Improve frequency of commuter rail service between Boston and Providence	Software	✓		
RI	Invest in T.F. Green Airport	Travel and Tourism			✓
CT	Increased use of commuter rail service	General	✓		
CT	Improved transit connections	General	✓		
CT	Improve High-Speed Rail connections and parking	General	✓		✓
CT	Enhance accessibility of airports	General			✓
CT	Provide transportation services in support of Welfare-to-Work	General			
CT	Enhance competitiveness of Bradley Airport	General			✓

Table 7-14: New England Cluster Needs Assessment Summary

Only Rhode Island looked at its transportation needs at a cluster-specific level. Rhode Island's transportation needs assessment was facilitated by the identification of more specific cluster types such as "Jewelry Manufacturing" and "Seafood Products," however state clusters found to have specialized transportation needs represented clusters in the lowest priority "potential" development stage. While the transportation needs framework has limited usefulness applied to the state cluster studies, it is apparent that investment in regional intermodal freight infrastructure is less important to the competitiveness of the state clusters as compared to the other two regional transportation issues. At the same time, it is not possible to ascertain the relative degree of importance given to regional airport investment versus I-95 congestion relief investment.

Implementation into Transportation Plans

The Rhode Island and Connecticut transportation plans each contained projects identified in the economic development initiatives as important for the state's clusters. Massachusetts transportation plans gave recognition to the cluster-based economic development policy, but did not specifically incorporate them into either the STIP or Boston's RTP. New Hampshire's transportation plan excludes economic development considerations altogether within its transportation plans. A high-level look at the institutional relationships helps to explain some of this discrepancy:

- Rhode Island is unique in that it has a single MPO responsible for both formally defining economic development goals and developing the RTP for the entire state. Though transportation organizations did not participate as stakeholders in the cluster initiative, the combination of (1) cluster-specific state legislation directed at the MPO; and (2) the MPO's integrated economic development and transportation planning authority, provided an institutional structure facilitating the translation of economic development goals into relevant transportation investments when necessary.
- Connecticut involved its transportation planning and service organizations as participants in the cluster initiative through its Transportation Infrastructure Advisory Board. The Board regularly updates the cluster leadership which includes lawmakers and the governor. The annual Transportation Summits provide a forum for prioritizing cluster needs for inclusion in the STP. Although the institutional linkages to the state's MPOs are not yet fully developed, the cluster initiative has created the Transportation Strategy Board with the explicit goal of developing these links.

- Massachusetts did not involve its transportation planning organizations in the cluster initiative, although they did participate in reviewing the formal state economic development plan. The economic development plan recognizes the state's clusters, but focuses its efforts on creating a healthy economic environment for all clusters, without specifically targeting any one. The policy approach is broad and provides little direction for the transportation organizations. Despite this, four of the five projects recommended by the state's cluster initiative are being implemented (the notable exception being support of container doublestacking). It is important to note that these projects lie outside of the state's traditional transportation process and have relied more on federal and state legislative intervention rather than a structured regional transportation planning approach.
- The New Hampshire cluster initiative's recommendation came out strongly against the policy of large infrastructure investments to support its clusters. With the subsequent adoption of the initiative as the formal economic development plan for the state, it is unsurprising that cluster-based transportation investment is not a component of the state's transportation plans.

Evaluation of Framework Usefulness

The chapter concludes with the following critical analysis of the application of the competitive advantage framework and observations regarding its usefulness within the ReS/SITE methodology:

- New England cluster initiatives were performed at scale (statewide level) which is inappropriate for analysis within the regional competitive advantage and transportation planning framework, and subsequently, it is difficult to ascertain the sources of New England's competitive advantage considered as a region. The state level does not provide an appropriate grouping of the economic regions contained in New England. A better scale would either be at (1) a more micro-level, assessing the competitive advantage of metropolitan economic regions with provisions for spill across state borders; or (2) a more macro-level assessment of the competitive advantage of New England as a single economic region, rather than the sum of six individual state jurisdictions.
- The lack of regional economic development and regional transportation planning organizations is a barrier to successfully applying the competitive advantage component of the ReS/SITE framework to the New England region.

- The application of the framework to New England did not result in specific recommendations regarding transportation infrastructure investments benefiting the region's competitive position, nor did it identify the process by which the investments would be prioritized or implemented. At best, within the competitive advantage context, the framework provides for the recommendation of prioritizing intermodal freight investments lower than investments for I-95 congestion relief or regional airport system improvement. The failure of the framework was due primarily to the two prior observations: an inappropriate scale at which to assess clusters and competitive advantage, and the lack of regional organizations capable of leading and implementing a cluster initiative for New England.
- The New England cluster studies did not assess specialized transportation needs on a cluster-specific basis. Instead, at best, general needs were given which could presumably benefit all the clusters. This observation is consistent with the findings from the Chapter 5 cases studies which were performed at the metropolitan, rather than state level. The usefulness of the cluster transportation needs assessment framework, presented in Figure 6-3, is certainly unclear. There are two interpretations: (1) the cluster studies are correct in their implicit assumption that transportation infrastructure has only a second order affect on cluster competitiveness and is best addressed at a more broad level, or (2) they are overlooking an important contribution of transportation infrastructure and would benefit from investigating specific needs for each cluster using the roles that transportation infrastructure may play in cluster competitiveness as presented in this thesis.
- Different philosophies on the government's role in cluster development hampers the ability of the framework to assess infrastructure investments at the regional level. New Hampshire explicitly precludes large infrastructure investments from their guiding cluster-development policies, and Rhode Island's policy is somewhat ambiguous. In contrast, Connecticut and Massachusetts both promote infrastructure investment as important for supporting the general needs of their respective industry clusters. If a regional approach is to be applied to New England transportation issues within the competitive advantage context, individual state philosophies must be brought into better alignment.
- Competitive tendencies are still apparent in the examination of economic development and transportation plans, preventing effective investment decisions at a regional scale. For example, New Hampshire's economic development plan focuses on improving the state's tax

and lower cost of living advantages to attract Massachusetts' firms. Also, Connecticut is looking at investment in Bradley Airport as a means to better attract traffic and freight away from other New England airports, rather than as a means to more effectively cooperate as a component of a regional airport system.

- The establishment of Connecticut's Transportation Strategy Board, described in Section 7.5.3 is consistent with the extended ReS/SITE framework. The Board is charged with evaluating transportation connectivity with the region, working with MPOs to implement a cluster-based transportation strategy at the regional level, and work with other New England states in developing a transportation strategy for the entire region. The ability of the Board to achieve these goals should provide a practical example of the strategies contained within the extended framework.
- The Cluster Initiative Architecture component presented in Figure 6-1 provided a useful framework for assessing New England cluster initiatives and their link to transportation plans. In exploring the Cluster Initiative Architecture, the importance of institutional links between economic development and transportation planning organizations was made apparent, as demonstrated by the differences in implementation of the cluster studies' recommendations.
- Evidence of institutional linkages between New England economic development and transportation organizations, and the varying degrees of the linkage effectiveness, provides support for the necessity of the Comprehensive Regional Architecture of ReS/SITE to contain a regional economic development component in addition to the regional service and planning components.

This completes the chapter's goal of evaluating the New England region within the context of the extended ReS/SITE framework. The next chapter will present the final assessment of the extended framework and identify further opportunities for more effectively addressing the integration of regional competitive advantage and transportation planning.

Chapter 8. Summary and Findings

In response to Sussman and Conklin's call [193] to more fully explore the regional strategic transportation planning framework within the context of regional competitive advantage and economic development, this thesis has pursued four basic objectives:

1. To develop the concept of regional competitive advantage and its relationship with industry clusters and economic development. This was the subject of Chapter 2.
2. To review the relationship between economic development and transportation planning, and explore case studies of past regional competitive advantage analyses and the corresponding regional transportation plans. This was subject of Chapters 3 through 5.
3. To provide a framework for integrating the notion of regional competitive advantage within a region's ongoing transportation planning process. This was the subject of Chapter 6.
4. To evaluate the New England region within the context of the proposed framework. This was the subject of Chapter 7.

This chapter will briefly summarize the material presented in this thesis. Section 8.1 will summarize the motivation for this thesis. Section 8.2 will review the key ideas presented in each chapter. Section 8.3 will review the key findings of this thesis. Finally, Section 8.4 will suggest some areas for further research.

8.1 Motivation of Thesis

Considerations for economic development within regional strategic transportation planning often focus on overly narrow measures of economic benefits for a region as a whole, such as job or wage growth, and business output. Regional economic development depends more strongly on the sources of regional competitive advantage, often associated with industry clusters and their sustained productivity growth. To more appropriately consider economic development, it was suggested that a shift towards a regional transportation planning approach is needed. This will identify, develop, and integrate transportation infrastructure investments which: (1) effectively support local industry clusters; and (2) create the opportunity to develop and maintain a regional competitive advantage through productivity growth. MIT's ReS/SITE framework was seen as providing a logical interconnection between regional competitive advantage theory and strategic

transportation planning, through its use of regional architecture [194]. By extending ReS/SITE's regional architecture component, we hoped to gain insight into how the notion of regional competitive advantage fits within the strategic transportation planning process.

8.2 Summary of Thesis

Chapter 2 provided an extended treatment of regional competitive advantage and industry clusters. An economic region, as defined by Pendleton [195], was shown to be the appropriate unit of geographic scale to evaluate transportation investments within the context of competitive advantage. Next, Porter's diamond framework of competitive advantage was introduced [196], and the natural outcome of the framework was shown to be the phenomenon of industry clustering, a concept that has become one of the leading drivers behind regional economic development policy.

The notion of industry clusters was shown to be difficult to apply in practice. For clusters to become a useful subject of analysis and policy, the concept needed to be more rigorously defined. To assist in this definition, clusters were classified by their stage of development and along five different dimensions. Three stages of development were given: a working cluster, a latent cluster, and a potential cluster; with working clusters representing the stage of development in which a region is realizing a competitive advantage. Using the progressive classification and dimension characterization, industry clusters could be segmented into categories for policy analysis.

A cluster-based economic development framework recommended by the U.S. Department of Commerce was introduced and described as a four-stage process: (1) the Mobilization Stage, (2) the Diagnostic Stage, (3) the Collaborative Strategy Stage, and (4) the Implementation Stage. The effectiveness of these cluster-based strategies was evaluated and critiqued, with the conclusion being that the benefit of industry clusters is not as much a "revolution" in regional theory, as it is a comprehensive approach for understanding regional economic conditions and trends. Clusters were seen as a mechanism for linking together several aspects of regional policy interests into a single framework.

The chapter concluded with the presentation of eight ways in which transportation planning and infrastructure could be integrated within the cluster framework:

- As a factor input within Porter's diamond framework of competitive advantage
- As a means of supporting and enhancing the efficiency of other competitive diamond inputs
- As a key component of a region's economic infrastructure
- As a key stakeholder and participant in cluster-based economic development initiatives
- As a facilitator of innovation
- As a facilitator of collaboration
- As providing scenario-specific efficiencies for cluster-based initiatives
- As an industry cluster itself

Chapter 3 differentiated between economic development and economic growth. Economic development was described as a *qualitative* change in the structure of a region's economy. Economic growth was seen as a *quantitative* change in the scale of the economy. Defined this way, economic development was seen as both a prerequisite and result of economic growth.

It was shown that with a sparse regional transportation network, the impacts of an investment could be more easily identified. Historically, a common rationale for investment decisions was based on the assumption that a high-quality transportation infrastructure was an essential prerequisite for economic development and growth. For more advanced economies, where transportation is already well-developed, a key question was seen to emerge: are the same arguments for linking transportation investment and economic development still relevant? The research of Banister and Berechman was surveyed in which they propose that new priorities are present in developed, regional economies that cause many of the traditional arguments to be weakened, or to even no longer apply. These new priorities include: (1) transportation investment increasingly viewed as a process with strong political, social, and environmental implications; (2) flexible location decisions by the public and industry create patterns of interactions and travel which are more complex; (3) new economic forces at work as regional economies move from manufacturing-based to service and information industries; and (4) a changed demographic profile of the population, with increased life expectancy and new household structures.

In summary, further investment in transportation infrastructure would not on its own result in economic development or growth. Instead, transportation investments acted as a complement to other, more important underlying, or "necessary" conditions. Banister and Berechman claimed that three sets of necessary conditions were required:

1. Economic conditions
2. Investment conditions
3. Political, policy, and institutional conditions.

Individually, the necessary conditions have little to no impact on economic development, and even if combined in pairs, their effect is limited. Bannister and Berechman argue that it is only when all three necessary conditions are present and working together that economic development from transportation investment will potentially follow.

The state of the practice regarding the degree to which transportation planning agencies include economic evaluation of infrastructure investments was explored; we found that regional economic development goals were rarely taken into consideration. Furthermore, the measurements used to evaluate the economic impact of investments were typically related more towards economic growth, rather than economic development. The chapter concluded by revisiting the notion of clusters and further linking them to transportation investment by the ability of the infrastructure to facilitate: (1) productivity improvement, (2) cluster specialization, (3) face-to-face communication, and (4) expanded access to specialized inputs and outputs.

Chapter 4 described the central function that the Metropolitan Planning Organization (MPO) sometimes plays in regional transportation planning, and examined the role MPOs may play in regional economic development policy. While less than one-third of MPOs have specific responsibilities related to economic development, most are involved to some degree in regional economic development planning. The MPO was determined to be an important integration point for the linking of economic development policy and transportation planning. However, the argument was made that the institutional responsibilities of a typical MPO preclude it from playing a leadership role in cluster-based initiatives, though they play an important supporting role in many of the efforts. The chapter concluded with the presentation of the ReS/SITE framework, highlighting the Comprehensive Regional Architecture component, with its methodology to describe institutional linkages and information exchange, as a promising point of integration between the strategic transportation planning framework and economic development initiatives.

Having introduced the concepts of regional competitive advantage, industry clusters, economic development, and regional strategic transportation planning in Chapters 2 through 4, **Chapter 5**

next examined four case studies applying these concepts at the metropolitan and state-wide level. The case studies were: the San Francisco Bay Area and Silicon Valley; the Twin Cities in Minnesota; Tucson, Arizona; and the Transportation Cornerstone Project in Florida. Several important observations from these case studies were made:

- Cluster-specific transportation needs are rarely identified. Common to all cluster studies was the identification of more general transportation needs applicable across all clusters.
- In general, the link between economic development and transportation planning is limited or absent in most regional economic and transportation plans. MPO-developed Regional Transportation Plans (RTP) offer general goals for economic-based considerations, but do not define measurable performance objectives, or recognize cluster-based economic development initiatives.
- For initiatives conducted at a statewide level, there is a mismatch in the geographic scope of the planning: identified clusters operate on a regional, national, and international scale, while transportation planning occurs at a decentralized level driven by individual MPOs.
- Although a region's cluster-based economic development organizations may play a very active role in assessing the region's transportation network, and are institutionally linked to the MPO, the RTP often does not reflect the economic development organizations' stated transportation priorities.
- A MPO-led cluster study does not guarantee that the MPO's RTP will be tied to cluster-based development as was demonstrated in the Twin Cities case.
- Project prioritization for inclusion in regional transportation plans generally reflect "home-to-work" travel issues such as travel time, delays, safety, and mobility; rather than a "goods-to-market" issues such as freight mobility and economic development.

Chapters 2 through 5 achieved the first two objectives of the thesis—developing the concept of regional competitive advantage and clusters, and examining the link between economic development and transportation planning in both theory and practice. **Chapter 6** considered the

third objective we ask the basic question—how does the notion of regional competitive advantage fit within a region’s ongoing transportation planning process?

In order to answer this question, Chapter 6 proposed using the cluster initiative framework, shown again in Figure 8-1, to examine the role transportation planning and service organizations play in a region’s cluster-based economic development policies.

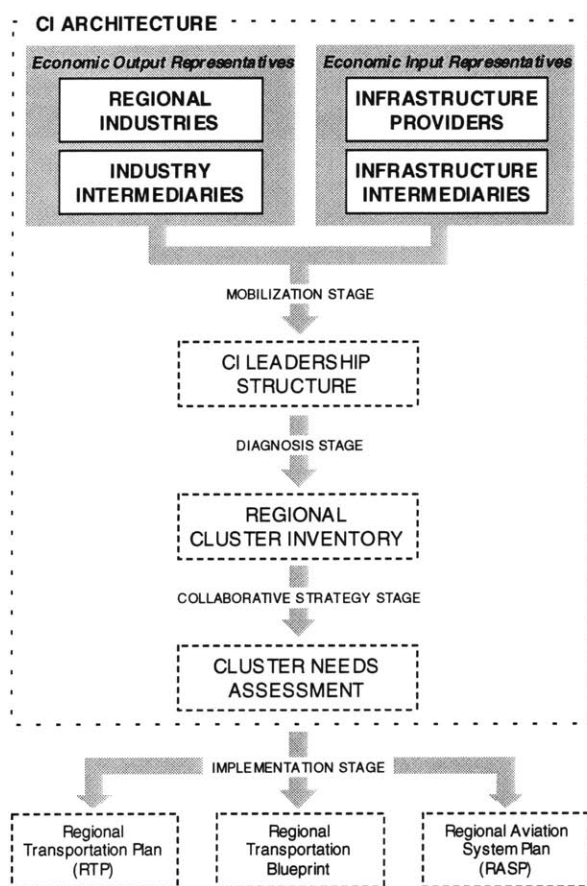


Figure 8-1: The Cluster Initiative Framework Revisited

Insight into regional economic development policy and its important institutional and informational linkages to transportation planning is gained through an examination of a cluster initiative’s economic input and output representatives, leadership structure, regional cluster inventory, needs assessment, and related regional transportation plans.

The needs assessment component was further developed with the intention of assisting transportation planning organizations in better determining the specialized infrastructure needs of individual clusters. Figure 8-2 graphically depicts the suggested systematic approach.

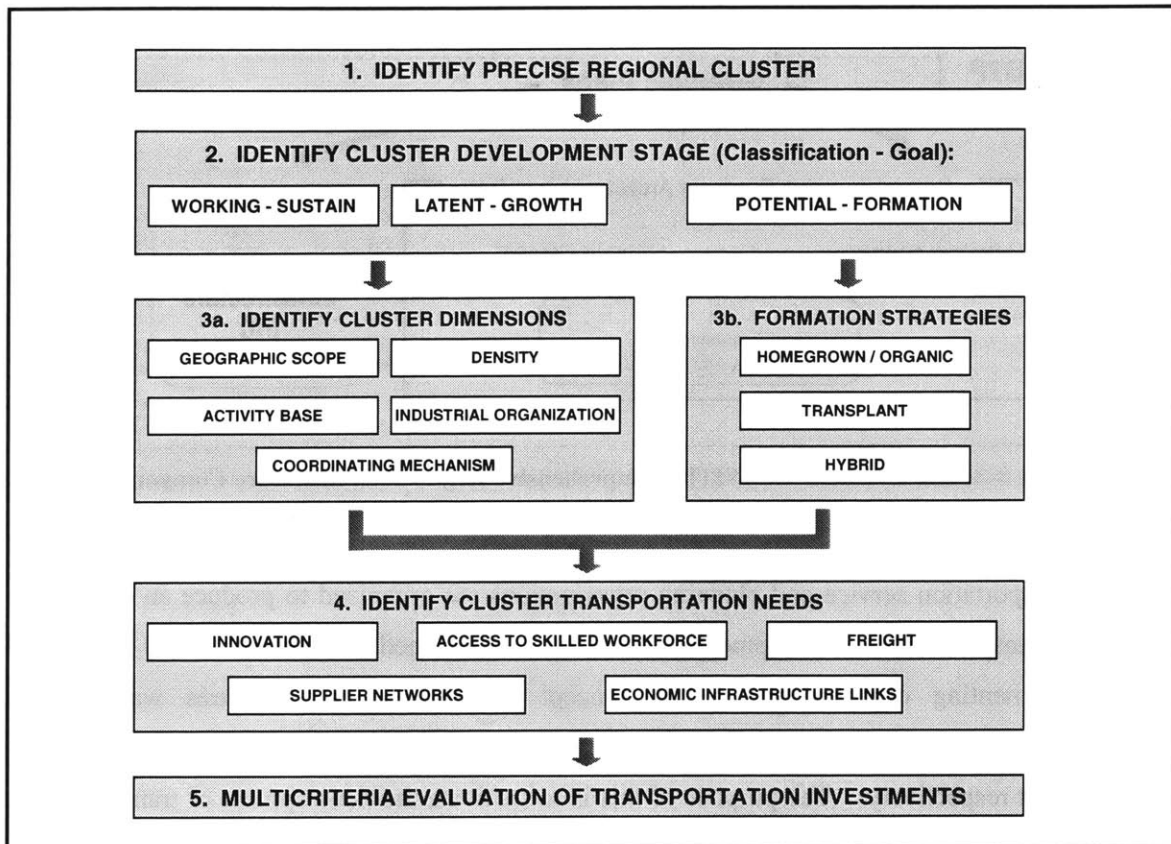


Figure 8-2: Cluster-Specific Transportation Needs Assessment

The reasoning behind the needs assessment was based on the argument that a factor input, such as transportation infrastructure, must be tailored to a cluster's needs if it is to contribute to sustaining competitive advantage. The more specialized the factor input is, the more scarce it becomes and thus more difficult it is for competing regions to replicate. By segmenting clusters by their development stage and dimension, it was hoped that a transportation planning organization could better evaluate an infrastructure investment's ability to assist in developing or sustaining the region's competitive advantage. However, based on the Chapter 5 case study results and the subsequent evaluation of the New England region in Chapter 7, it was determined that existing cluster studies do not provide a sufficient level of detail from which to make an effective assessment of a cluster's specialized transportation needs.

Chapter 6 concluded with making the required adjustments to regional architecture in order to incorporate economic development initiatives in addition to service and planning activities, as shown in Figure 8-3:

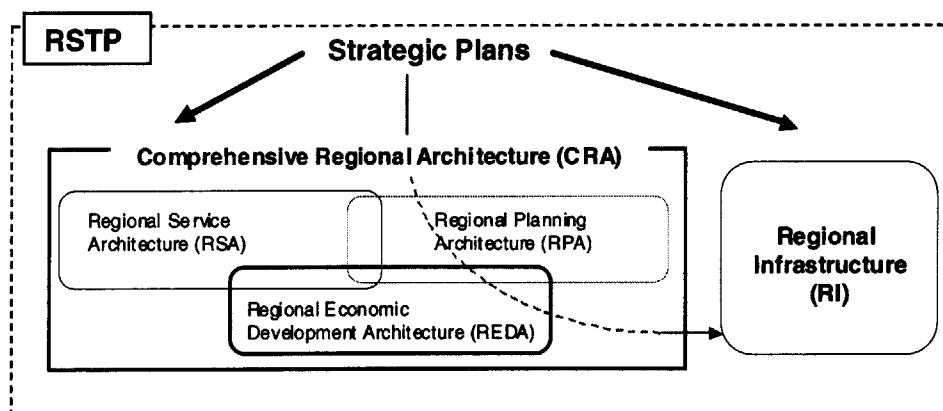


Figure 8-3: The Extended ReS/SITE Comprehensive Regional Architecture Component

Just as transportation service and planning organizations are organized to produce an integrated series of plans, economic development-oriented institutions need to coordinate their initiatives with implementing organizations. The concept of Regional Architectures was further differentiated to address the subset of institutions that focus on planning, services, and economic development respectively. The purpose of this is to motivate the development of transportation plans and services that are more robust with respect to regional competitive advantage. Chapter 6 expanded Makler's Comprehensive Regional Architecture to include the Regional Economic Development Architecture (REDA). The Regional Strategic Transportation Plan (RSTP) now includes components which (1) address anticipated transportation investment needs based on the set of possible regional outcomes captured in scenarios – the Regional Infrastructure, and (2) address the set of relationships that describe how the service, planning, and economic development institutions interact to provide an integrated set of transportation plans within a region – the Comprehensive Regional Architecture (CRA).

The addition of the REDA enabled the Strategic Plans component of ReS/SITE to incorporate the planning responsibilities covering each of the three necessary conditions, identified by Banister and Berechman in Chapter 3, that are required before economic development can occur. Planning related to regional *economic conditions* is contained within the REDA architecture,

while *political, policy, and institutional conditions* is jointly contained within the RPA, RSA, and REDA architectures. Lastly, the actual *investment* is contained within the RI.

The implication of this revised RSTP is that the ReS/SITE framework now involves a more descriptive analysis of a strategic transportation decision-making process, incorporating important elements of regional competitive advantage and addressing clusters' collective transportation needs. Using clusters as a frame of reference, the REDA architecture has the potential to give additional insight into economic development needs that would not typically be considered within the traditional transportation planning process.

Chapter 7 addressed the fourth and final objective of the thesis, the application of the framework to the New England region. Pendleton's region classification scheme was first used to validate the assumption that New England could be considered, to a first approximation, an economic region rather than simply six separate political jurisdictions (i.e. states). After identifying regional economic development and transportation planning organizations, transportation issues impacting the entire region were assessed and categorized into three broad areas: I-95 congestion relief, improvement of intermodal freight competitiveness, and improving the regional airport system. It was proposed that the extended ReS/SITE framework could provide a helpful context in which to evaluate and prioritize these infrastructure investments for New England in consideration of cluster needs.

Using the cluster initiative framework, the states of Massachusetts, Connecticut, New Hampshire and Rhode Island were evaluated and the institutional linkages between economic development and the transportation plans identified. The chapter concluded that within the competitive advantage context, New England intermodal freight investments should be prioritized lower than investments in I-95 congestion relief or regional airport system improvement. Additionally, in exploring the Cluster Initiative framework within New England, the importance of institutional links between economic development and transportation planning organizations was made apparent, as demonstrated by the differences between states in implementation of the cluster studies' recommendations within the transportation plans. Finally, because the New England cluster studies did not assess specialized transportation needs on a cluster-specific basis, the usefulness of the cluster-based transportation needs assessment approach, developed in Chapter 6, was limited. However, in general, by considering clusters collectively for a particular region, it is

possible to add transportation as a broad need beyond what is traditionally considered in economic development planning.

8.3 Key Findings of Thesis

There are several key findings that can be drawn from this thesis. Each of these is described in as follows:

- **For assessing competitive advantage considerations within regional strategic transportation planning, industry clusters may provide a useful starting point.** A region is said to gain competitive advantage if it is able to sustain a growth in productivity. Regions able to gain competitive advantage exhibit an economic environment which promotes geographically concentrated clusters of industries. It follows, that to address competitive advantage within transportation planning, it is beneficial to consider transportation investments in the context of industry clusters. The popularity of cluster-based economic development policies is growing in the United States, and to fulfill TEA-21's charge that transportation investment decisions support metropolitan economic vitality, the need to integrate cluster-based policies and goals within on-going transportation planning is more relevant. The cluster initiative framework presented in Chapter 6 provides a useful means to identify (1) the key stakeholders of a cluster-based initiative, (2) the leadership structure and roles played by transportation planning organizations, (3) the inventory of important regional clusters, (4) the infrastructure needs of the clusters, and (5) priority cluster-related investments for implementation within the relevant transportation plans. Through this methodology, the important institutional linkages between economic development and transportation planning organizations can be better identified and improved.
- **In a developed economy, it is very difficult to determine how regional transportation planning can support individual clusters' specialized needs.** The scale of a cluster's individual needs is on a micro-scale when compared with the macro-scale of a region's overall transportation needs. However, this is not to say that a general strategy to establish, develop, or grow regional clusters should not include effective regional transportation planning. By combining needs over multiple clusters, generalized needs can be assessed and an overall cluster support strategy could be incorporated in regional transportation planning. Incorporation of the generalized needs may result in transportation planning choices different from decisions made without consideration of regional clusters. Overall, the scale of

providing general cluster support, rather than individual cluster support, is better matched to the scale of regional transportation planning.

Some examples of general cluster needs which could be supported by transportation planning at the regional scale include:

- *Improved Quality of Life:* In developed economies, many of the regional clusters will be knowledge-intensive industries, requiring a workforce with intellectual capital. To attract and retain this type of workforce, regional quality of life issues are important. Congestion and reduced mobility can constrain and reduce regional quality of life and negatively impact all clusters. Regional transportation strategies which address these issues can support overall regional cluster needs.
- *Effective Face-to-Face Communication:* Face-to-face communication is considered essential for any type of cluster development, playing an important role in providing informal linkages between companies within clusters which facilitate both innovation and cooperation, two important factors of competitive advantage. Strategies improving the effectiveness of inter-regional and intra-regional transportation linkages will have an impact on the efficiency in which face-to-face communication occurs for all regional clusters.
- *Access to Specialized Inputs:* Cluster firms benefit by having a broader and more qualified supply of specialized inputs such as a labor force and suppliers. Marginal productivity of the clusters can improve as inefficient inputs are substituted by expanding the access to more highly productive and efficient services. Regional transportation investments in inter-city networks, such as commuter rail for increased access to skilled labor, or improved freight corridors for increased access to suppliers, can support the general specialized input needs of multiple clusters.
- **In developing economies, the scale of individual cluster needs and transportation planning may be better matched as the industries and transportation networks are earlier in their development stages.** With a smaller number industries and few inter- and intra-regional linkages, a developing country's potential clusters might benefit from tailored transportation investments.

- **Consideration of the scale at which cluster-initiatives are performed is important in determining the appropriateness of addressing competitive advantage within regional transportation planning.** Similar to the prior finding, Pendleton’s assertion that economic and transportation activity should be planned and managed on approximately the same geographic scale holds true for cluster-based initiatives and regional strategic transportation planning. The appropriate geographic scale within the competitive advantage context is the economic region, although many cluster studies are performed at a political jurisdiction-based scale, such as at the state level. Unless regional transportation planning and economic policies are aligned at the same scale, the ability to evaluate and prioritize transportation infrastructure investments with competitive advantage considerations is, at best, limited.
- **The addition of a Regional Economic Development Architecture (REDA) component to ReS/SITE extends the usefulness of the framework.** In the cases studied in Chapter 5, regional clusters were not considered in the way in which the extended ReS/SITE can do through its REDA component. Therefore, the outcomes of the transportation planning processes examined may well have been different had the ReS/SITE framework been used. Even with well-established cluster-based economic policies in regions such as the Twin Cities and Silicon Valley, there existed a mismatch between the economic goals of the regional transportation plans and the policies of the economic development organizations. A review of New England showed that the degree to which the cluster policies were reflected in transportation plans was affected by the nature of the institutional linkages between the transportation and economic development organizations. Including REDA within the ReS/SITE framework provides the opportunity to map these linkages both as they exist in practice and as an example of “best-practice” under more ideal institutional relationships. Furthermore, Regional Infrastructure (RI) and REDA are not discrete or independent elements. The extent to which the RI is actually deployed depends on the REDA’s ability to identify and prioritize investments which support a region’s competitive advantage, and integrate them within the Regional Planning (RPA) and Regional Service (RSA) Architecture elements. The extended ReS/SITE framework as proposed by this thesis is shown in Figure 8-4:

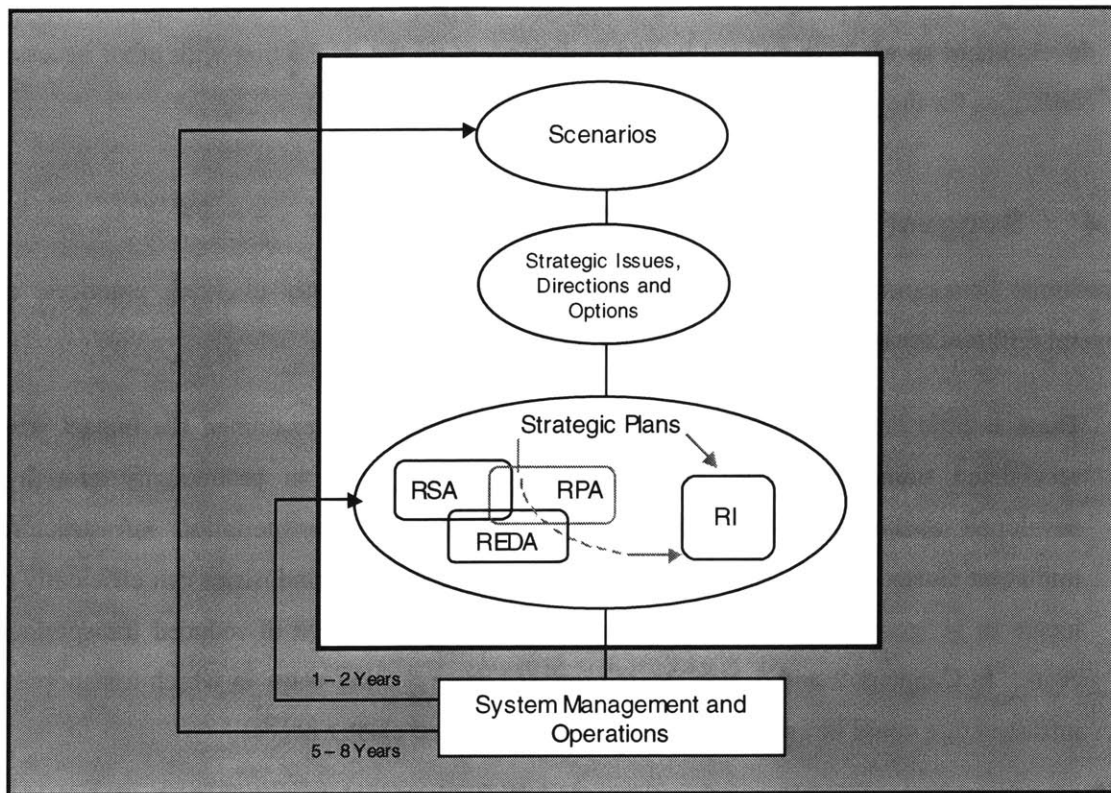


Figure 8-4: The Extended ReS/SITE Framework

The integration of REDA within the Strategic Planning component of ReS/SITE also provides an opportunity to address two other shortcomings of current transportation practice: (1) the necessity to integrate regional freight movement needs, and (2) the need to adequately involve private sector entities. Because both freight and private sector entities are typically well-represented within the framework of economic development initiatives, their roles and involvement will also be expanded within the on-going regional transportation planning process.

- **Metropolitan Planning Organizations (MPOs) often play a central role in transportation, but rarely have the institutional capacity to successfully lead a cluster initiative.** Although the MPO might play an active role in the cluster initiative, except for some unique examples, it does not have the institutional capacity to lead a cluster-based economic development initiative. A cluster initiative, undertaken in order to support the development of regional competitive advantage, relies on regional transportation planning architecture components within its process; this means that the ReS/SITE framework is dependent on the *pre-existence* of a cluster initiative if it is to effectively incorporate regional competitive

advantage within its components. Transportation investment alone cannot result in economic development as we have defined it, and is dependent on the interaction with other necessary conditions for the potential that economic development will occur.

8.4 Suggestions for Further Research

Economic development policy and regional planning are constantly evolving practices, and several different areas could benefit from further research as described below:

- There is little empirical cluster research which has rigorously examined the impact which specialized transportation infrastructure might actually play in productivity growth in developed economies. Most studies simply assume that transportation infrastructure's important cluster-specific role is in providing a means by which industries can efficiently co-locate in geographically concentrated areas by taking advantage of reduced transportation costs. In Chapters 2 and 3, this thesis proposed several other ways in which transportation infrastructure could be considered in meeting specialized cluster needs.

A logical follow-up to this research includes looking into the specialized transportation needs of individual types of clusters. To date, cluster initiatives typically regard transportation investments as second order impacts; however this research has proposed several broad categories in which transportation infrastructure might affect the competitive advantage of individual clusters, such as impacting face-to-face communication (allowing for innovation) and improving access to specialized inputs such as skilled labor. It would be beneficial to explore several types of specific clusters, for example mutual fund or medical devices clusters, in order to empirically determine what transportation investments could in fact impact cluster competitiveness. An approach similar to the methodology for Florida's Transportation Cornerstone Project, as described in Section 5.4, could be used.

- This research has only evaluated cluster initiatives in the United States. In reality, the concept of clusters and competitive advantage has gained popularity across the developed world. The scope of the research could be expanded internationally to assess the degree to which cluster-based policies are reflected in transportation planning, and describe the different institutional linkages that exist in other countries. Additionally, evaluation could be made of the notion that that assessment of specialized transportation needs for industry clusters may be more relevant for regions in the developing world.

- It would be interesting to expand the causal loop map presented in Figure 5-2 into a working System Dynamics model in order to quantify and compare the relative effects of improving different factor inputs to a regional cluster. This type of model could also be used to evaluate the benefit trade-offs which may occur between an infrastructure investment tailored specifically to an individual cluster, or an investment which serves the more general needs of multiple clusters. Do the economic development benefits achieved through increased competitive advantage from a single cluster outweigh the more general benefits gained from less-specialized investments impacting multiple clusters?
- The proposed Regional Economic Development Architecture (REDA) component of ReS/SITE was introduced at a very high level within this research. The framework would benefit from a detailed architecture map describing the specific information flows and institutional relationships between economic development and transportation planning organizations. Candidates for this map might include the Bay Area, Rhode Island, and after its Transportation Strategy Board is implemented, Connecticut. From a theoretical aspect, it would also be interesting to design the regional economic and transportation institutions and plans that would be needed to undertake successful integrated strategic planning (economic and transportation) for New England at the regional level.
- Benefit would be gained by an expansion of the ReS/SITE framework to describe how regional economic development goals and needs could be reflected in the shorter-range operational and system management plans. Similarly, it would be helpful to determine appropriate and practical measures for evaluating short- and long-range transportation plans within the context of regional competitive advantage.
- It would be interesting to expand the REDA beyond the notion of clusters. An assessment could be made of other economic development policies which are currently employed and the degree to which their goals are incorporated into the transportation planning process.

This thesis has attempted to advance the ReS/SITE framework and strategic transportation planning by incorporating consideration for regional competitive advantage. It is hoped that this research will generate interest into developing a better understanding of the ability of transportation infrastructure investment to impact a region's competitive advantage and economic development.

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Appendix: Transportation Planning Shortcomings and ReS/SITE

The ReS/SITE project identified eight categories of short comings in regional strategic transportation planning through a review of strategic plans from the Netherlands, the States of Washington, Iowa, New Mexico, Florida, and others. What follows is are excerpts from the Sussman and Conklin paper (2001) summarizing the shortcomings and describing how the ReS/SITE process addresses these planning shortcomings [197]. A list of references for the ReS/SITE research is also provided.

Excerpted from Sussman and Conklin (2001):

Intermodalism

Intermodalism can be described as using different, interconnected modes of travel to complete a person trip or freight movement. The importance of intermodalism is often overlooked, as are intermodal connections and multimodal solutions to problems. In practice, many plans can be characterized as a set of modestly-related unimodal plans rather than an integrated intermodal plan.

The ReS/SITE process is inherently intermodal in nature. Intermodal planning is enhanced by the regional architecture output of the planning process. This regional architecture defines how agencies with different modal responsibilities should cooperate in providing transportation services. The process encourages considering different modal solutions to problems the region is facing with different outcomes for the various scenarios considered.

Technology Scanning

Technology scanning involves considering which technological developments will impact transportation systems and how. For example, one could examine new ITS technologies and vehicle developments to help determine what type of system management techniques may be available with the planning horizon that are not available today. Few regional strategic plans include such an element.

A technology scan is an important component of the planning process. The planning agency could apply the ReS/SITE scenario process to consider the impacts of technology. The agency

can then consider what new technologies may have an impact on the future requirements and operation of the transportation system and prepare the plan to accommodate these future developments. Further, the regional architecture, with its ITS roots and an emphasis on information technology and communications, is responsive to new technological approaches to solving transportation problems.

Freight

Many transportation plans do not adequately address the needs of freight movement. Much of transportation planning emphasizes passenger transportation; freight mobility is given less attention despite its criticality for regional economic development.

Freight services providers should be included in the ReS/SITE regional architecture. These entities, such as railroads and motor carriers, have the explicit business responsibility for operating a service. The relationships between these operators and the providers of the infrastructure they use should be explicitly addressed in the development of a regional architecture. Freight mobility is an important service provided by the transportation system and essential to maintaining the economic health of a region. Different freight transportation requirements will be highlighted in different scenarios.

Private Sector Involvement

Transportation planning today does not adequately involve private sector entities such as major employers, shippers, and carriers. Public sector agencies and citizen activists largely dominate the process with modest opportunity for input from the business community. While the ability of the private sector to deliver needed transportation infrastructure through creative public-private partnerships has been taking hold, the role of such partnerships in more process-related, regionally-scaled planning has been limited.

Private-sector entities, such as major employers, manufacturers, and service providers in the region, should be involved in the regional architecture. It is important that the needs of the local business community are addressed in the products of the ReS/SITE planning process. The role of the business community in the regional architecture and the private sector's ability to deliver new infrastructure should be outlined in the plan. The private sector can also be included in the planning process through scenario development in which the perspectives of private-sector organizations on the future can be explicitly reflected.

Economic Integration

Transportation and economic development are inherently linked. Most transportation plans do not adequately assess the importance of transportation investment in retaining or achieving a competitive advantage, especially in the context of the global economy. Also these plans sometimes fail to address the local economic development needs that can be spurred on by transportation investment.

This shortcoming is addressed through the development of scenarios. Different economic effects can be explicitly reflected in the planning process. Furthermore, the scenario development process can assist the region in developing a plan that is robust across varying degrees of economic vitality.

“National Information Infrastructure” (NII): Telecommunications/Transportation Relationships

The transportation system is placing increasing demands on the “National Information Infrastructure” as ITS technologies continue to be employed around the world. Further, transportation infrastructure is often used as a right-of-way for information infrastructure. The interdependence of these systems is rarely addressed in transportation plans.

The NII should be an important component of ReS/SITE’s regional architecture in that it enables high levels of interaction between different institutions. Further, it is appropriate to consider how changes in the NII may affect the transportation system through the scenarios, in addition to developing an independent assessment of the interactions between these two systems. The planning process should outline the communication requirements of operating the transportation system both in terms of the institutions involved and the infrastructure needed.

Master Plan Perspective

Many transportation plans are focused on capital investment rather than the operation of the regional transportation system. The plans often simply identify specific projects, implementation requirements, and timetables rather than considering the overall operation of the regional transportation system.

The ReS/SITE process focused on regional competitive and quality of life goals, rather than on a project-selection process. Further, through developing a regional architecture focused on

information sharing, the process is not focused solely on infrastructure delivery. Rather, the ReS/SITE process is focused on meeting transportation needs of the region through operations as well as investment.

Human Resource Development

Strategic plans rarely address the need to develop transportation professionals for the future. The plans fail to address the “human capital” needs of the transportation system.

To an extent, scenarios, viewed as a mechanism to broaden the perspectives of planners have a human resource development aspect. In addition, it is important that the planning agency address these human capital issues independently as part of their planning process. The human resource requirements of operating the transportation system should be identified and a plan for developing these resources should be outlined.

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